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UNIVERSITY OF ALBERTA

The Antecedents of Retailing Productivity and Performance

BY

Peter Christopher Dubelaar

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfilment of the requirements for the degree of Doctor of Philosophy

in
MARKETING

Faculty of Business

Edmonton, Alberta
Spring 1996

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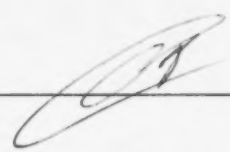

1 Harper House
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University of Sydney
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Australia

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled The Antecedents of Retail Productivity and Performance submitted by Peter Christopher Dubelaar in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Marketing.

Dr P. Larson

Dr H. Timmermans

Dr T. Scott

Dr D. Weins

Dr R. Lusch

January 29, 1996

Date

Dedication

To Diana

Abstract

This thesis studies the relationships among those factors that have been identified as antecedents to retail productivity. The study uses an analysis approach not yet seen in productivity studies to achieve its results (structural equation modelling) as well as using the standard regression approach. These two methods, between them, allow the testing of five key hypotheses about the relationships under study. The hypotheses are based upon the shape and direction of the relationships as well as the existence of an underlying total productivity construct which drives firm output and thus performance.

The study uses data collected in three stages. A pretesting stage from one chain in Canada (response rate: 76 from 101 possible), a general run on a second chain in Canada (response rate: 79 from 111 possible) and finally a major run in New Zealand on independent chemists (response rate: 564 from 1060 possible).

These samples were drawn from the health and beauty aids (HBA) sector of the retail economy. This sector has not been previously studied in this fashion and earlier work has suggested substantial cross-sector differences in the relationships among the studied variables and productivity.

The combination of the new data, new techniques and new approach to the problem of retail productivity measurement provides three major contributions to knowledge in retailing. First, the direction and shape of relationships in retail productivity are examined in depth to sort out the contradictions that exist in the literature. Second, the form of the model that represents the flow from resource variables through productivity to performance variables has not previously been operationalized or tested in any form. Third, these

relationships and this model are tested using the more rigorous technique of structural equation modelling.

Acknowledgements

I would like to acknowledge the assistance of several people whose help has been instrumental in completing this dissertation. In particular, I thank Paul Larson for his supervision, Mukesh Bhargava for his suggestions and moral support throughout, David Taylor for his assistance in collecting the data in New Zealand and the two managers from the Canadian chains whose cooperation has improved this study immeasurably.

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Introduction

Canadian retailing is facing new and more intense challenges in the 1990's. These challenges are in the areas of international impact, greater accountability, rapid changes in technology and its cost and changes in the way consumers shop.

Starting with the international impact, Canadian retailers are facing pressures from several sources outside their own operating sphere. Some of these forces are a result of the changes in trade agreements (the Canada-USA Free Trade Agreement) which are allowing freer movement of goods and the people and firms who sell them across the border. This has resulted in more than 40 Canadian retailers expanding internationally, primarily in the United States. The success of these expansions is yet to be determined. Other effects of the globalization of markets are the increase in the numbers of shoppers who cross the USA border to do their shopping. In five years from 1986 to 1990, the number of people engaging in cross border shopping doubled although recent decreases in the value of the Canadian dollar has seen the level of cross border shopping drop again. Finally, the costs of doing business for a retailer in Canada have increased more than their counterparts in the United States, particularly in the area of rental prices (Government of Canada, 1991).

In terms of management accountability to shareholders, hindsight is showing Canadian retailers that the eighties were a period of poor control, poor productivity and overbuilding (Government of Canada, 1991). These issues are highlighted through the numbers of large Canadian retailers who have experienced troubles: Birks and the Campeau Corporation are two examples of this trend with both filing for bankruptcy protection.

Technology too is changing in retailing with retailers making decisions as to whether to introduce the latest in point of sale equipment and electronic data interchange facilities now or later. Some retailers, such as Safeway, have gone for the new technology and facilities while others are examining their options more thoroughly. Shoppers Drug Mart has recently embarked on a campaign to upgrade its stores to point of sale scanners after longstanding resistance to the idea from management (SDM Annual Report 1992).

Finally, consumers are changing their attitudes and shopping behaviour. The average consumer in Canada is both better educated and more demanding than he or she was in the seventies and eighties. Couple that with the fact that western parts of Canada are seeing an upsurge in interest in larger stores (e.g., The Great Canadian Superstore, Costco, Save on Foods) and the retailers are faced with a dynamic environment.

Each of these factors has led to an increase in competition and interest in the bases for competition. Looking over the history of retail productivity, Ingene (1982) states:

> Productivity gains are vital to achievement of a higher standard of living in any developed society. Stagnant productivity is virtually synonymous with . . . poor profit performance in the business sector (p 75).

All of this turmoil in retailing has renewed interest in the way retailers do business, specifically their productivity.

Early productivity research focussed on the development of production functions for retailing, relating capital and labour usage to output production (e.g., Lusch and Ingene, 1979). This approach has persisted but was initially questioned by Ingene (1982) who suggested the inclusion of other variables in the function.

The study of retail productivity was at its most intense in 1984 with a special issue of the Journal of Retailing devoted to that topic. Since that time, little additional work has been done with occasional papers appearing in various journals. Despite the interesting issues raised by several of the papers in the special issue in 1984, little academic effort to fully explore the relationships among the antecedents of retail productivity and performance has emerged. One exception to this is a special issue on efficiency measurement in the International Journal of Production Economics (vol 39, no 1,2 April 1995). The issues explored focused mainly on the measurement of efficiency and productivity as opposed to how to maximise these quantities (see, for example, Fare et al 1995).

This lack of effort is made more surprising when the changes that have taken place over the past ten years in retailing are considered. This set of dramatic changes in the retail industry, along with the fact that several questions about the relationships among the antecedents of productivity have not been answered suggests that this area is in need of further study.

This thesis addresses several of the issues raised in the literature and will update our knowledge of retail productivity in light of substantial structural changes in the industry. To put retail productivity into perspective, it is necessary to see how it flows from the situation in which retailers find themselves. According to Morgenstein and Strongin (1992, p. 5) retailing is " . . . the selling of goods and services to their ultimate consumers." Retailing is also ". . . a high-contact service business characterized by an irregular rate of customer flow" (Samiee 1990, p 55). Given these conditions, the retailer must make decisions which "optimise" performance. The quality of the decisions a retailer makes regarding their

operation are reflected in the operation's performance and productivity. **Figure** 1 shows the

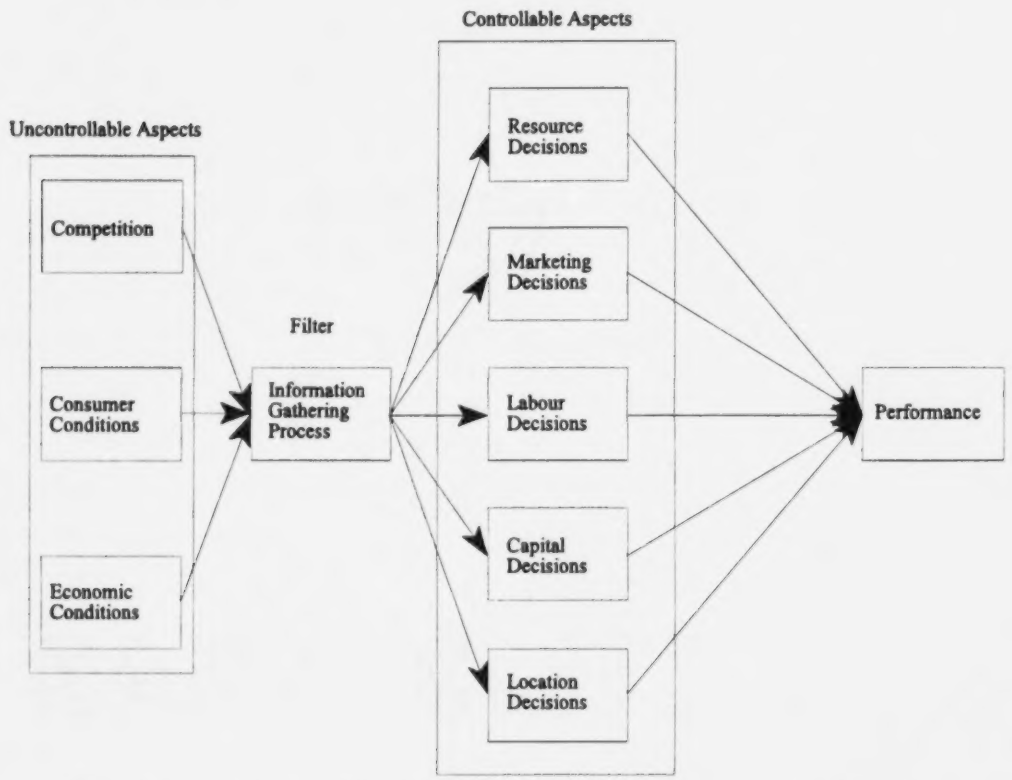


Figure 1 A manager's view of the relationship between external environment and performance.

relationships among the parameters and variables that a manager must consider.

While this model shows the world as the manager sees it, a more comprehensive model of the real world might be as seen in **Figure 2**:

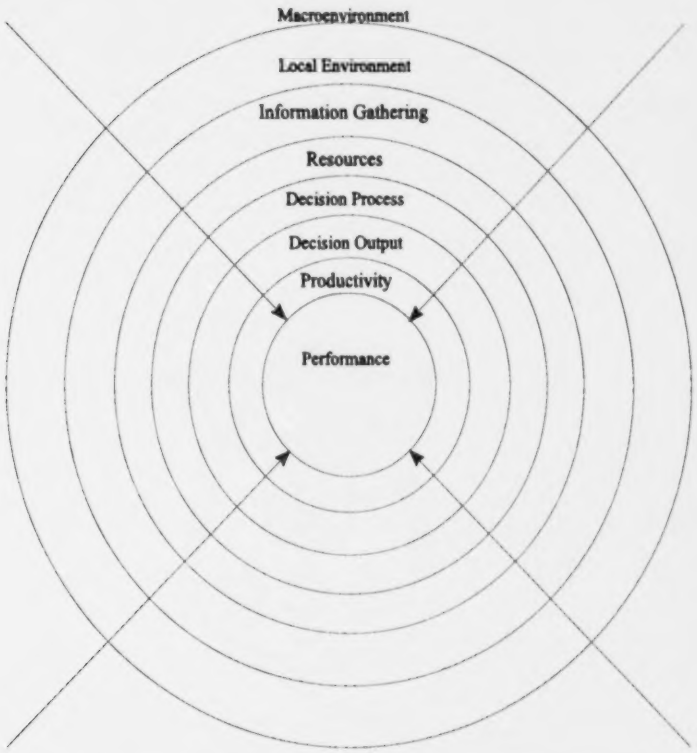


Figure 2 A real world view of the influences in retail decision making.

Figure 2 shows the dependence of the various aspects of retail decision making on the environment, both local and macro, upon the information gathered by the decision maker, the resources at his or her disposal, and the decisions that are made based upon all of this. These factors and activities result in productivity, which, given the circumstances in which the firm finds itself, creates the performance of the firm.

This framework specifies the way in which retailing is examined in this thesis. Decisions are taken by the retailer which are expected to have an impact upon the performance of the operation as a result of the issues shown in **Figure 2**

The remainder of the thesis will examine the area of the model in **Figure 2** that is representative of the decision making process and the results of that decision making process.

Specific Issues

This thesis addresses four specific issues. First, it defines the terms in use in the measurement of productivity and performance in retailing. The discussion in the literature as to which measures to use has been unnecessarily complicated by the fact that the same terms mean different things to different people. This work will begin by setting out unequivocal definitions for all the terms in use.

Second, it develops a formal structural model of the antecedents of retail productivity and performance extending beyond the basic production function that we find in economics. The basic production function is one in which a series of inputs are related mathematically (deterministically) to the production of one or more outputs.

Third, it updates the knowledge of retail performance and productivity through the collection of entirely new primary data from retailers.

Fourth, it uses the updated data to test the developed model of retail productivity and performance via two methods. Newer methods have become available and accepted that should help to shed light on the relationships among the antecedents of retail productivity and performance.

The thesis proceeds in the following order. First, a literature review is presented which details work already accomplished and notes the research gaps that this preceding work has either highlighted or omitted. Second, a proposed model of retail productivity is developed and presented which stems from the literature review. Third, a set of hypotheses about the model is presented which this thesis will test. Fourth, the analysis techniques that will be used in the testing of the presented hypotheses are discussed. Fifth, the data collection requirements for testing the hypotheses are delineated with special attention to the quality of the data. Sixth, the hypotheses are tested with the data using the techniques described. Seventh, the meaning of acceptance and rejection of the various hypotheses are discussed with particular attention to both the managerial and academic ramifications of each result. Eighth, and finally, a plan for future research is laid out to chart the path from this point forward.

Contributions

This work makes contributions to two groups: first, to academics, as it advances the state of the art in retailing productivity analysis through the use of newer tools and the

examination of several interesting and contentious issues. Second, to retailers, as it will help in decision making with respect to the use of scarce resources. Each of these contributions is detailed below.

To Academics

This work makes two basic contributions to the academic community. First is the exploration of a complete model of retail productivity in an updated data set purpose-built for this task. This exploration addresses questions regarding such issues as returns to scale on the input variables, which variables are related to productivity and the form of their relationship.

The second contribution is the application of an alternative means to developing and testing the complete productivity model. This is the structural equation modelling approach and offers unique advantages and disadvantages over the previous ANOVA and regression approaches.

To Practitioners

Retailers will find this work worthwhile as it develops a model of the way retail decision factors affect store productivity. Productivity is the key decision factor recognized in the business approach to maximizing store performance where store performance is generally defined in terms of sales (Goodman 1985). Thus, business people will have a more complete understanding of the means in which their operational and strategic decisions affect their long run competitiveness in terms of productivity.

Chapter I

Literature Review

This chapter explores the relevant literature in retail productivity, performance measurement and performance modelling. Its purpose is to delineate the efforts of previous authors and to indicate the areas they have highlighted as still requiring research as well as to indicate where their work can be extended. **Figure 3** lays out the relationships among the literature extant. The framework defined in **Figure 3** will be followed throughout the literature review to provide continuity. To that end, this chapter is split into subsections, each dealing with a specific aspect of the manner in which the literature has explored the antecedents of productivity and performance as described in **Figure 3**.

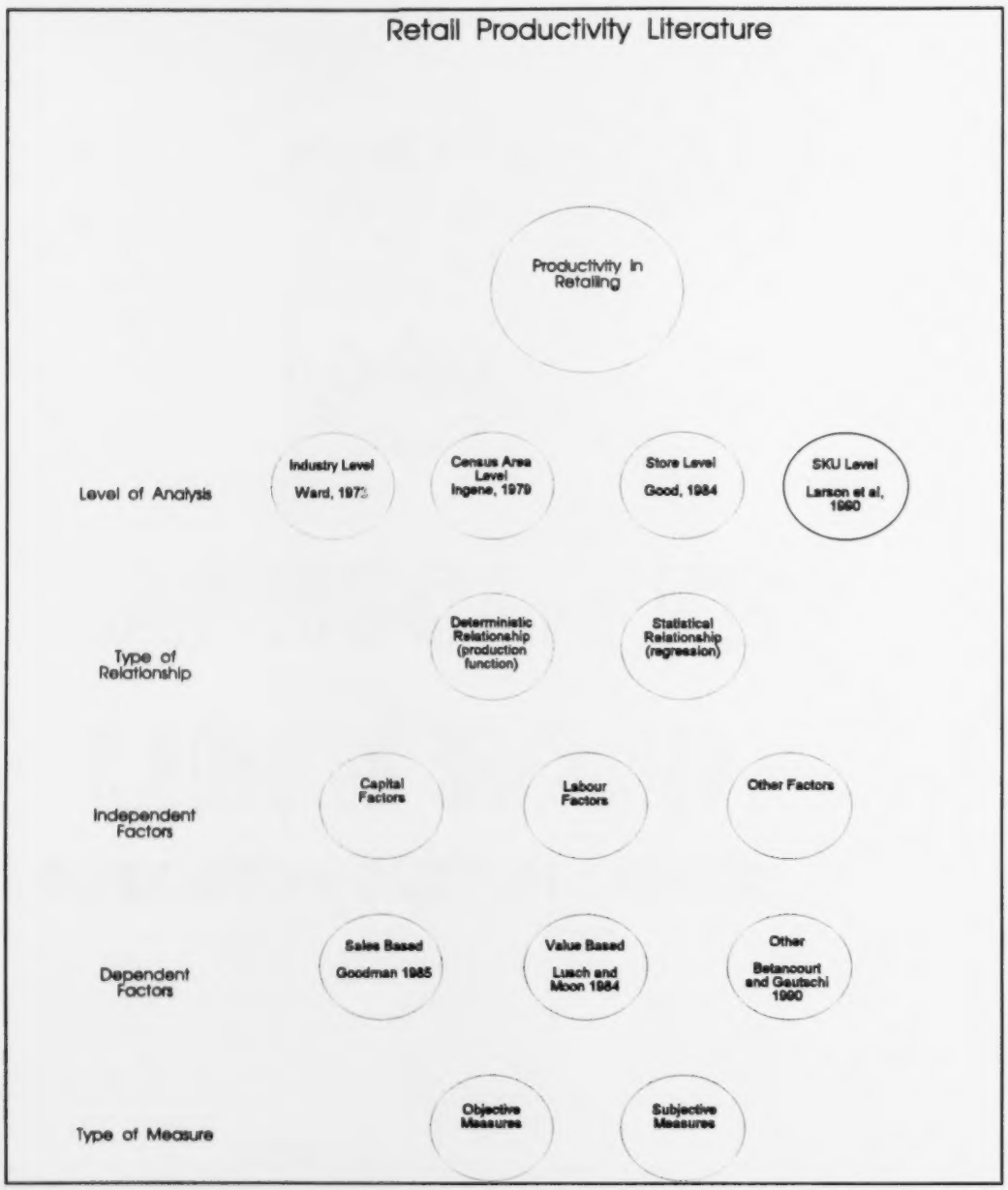
Exploring the Productivity Relationship

In order to establish a firm footing in this area, it is necessary to first define the various terms as used in this thesis[1]. The first term that must be defined is productivity itself. The concept of productivity is borrowed from economics (Varian, 1984) in which context it is a measure of the number of units of output per unit of input (e.g., sales per square foot). Equations **(1)**, **(3)** and **(4)** show the economic approach to this concept. The variable O is the output under investigation (say sales) while L and K are the inputs, usually labour and capital respectively. The function implied in equation **(1)** can be of any form, although the Cobb-Douglas equation (see equation **(2)**) is often specified due to its convenient form and its ability to display interactions through its multiplicative structure (Varian, 1984 p 172).

---

[1]The first three definitions (of productivity, efficiency and effectiveness) are based on Achabal, Heineke and McIntyre (1984, p 112).

Figure 3 Retail Productivity Literature



$$O = f(L,K,\ldots)$$ (1)A Basic Production Function

$$O = A \cdot L^{b} \cdot K^{c}$$ (2) The Cobb-Douglas Production Function

$$Average\ Productivity = O/L$$ (3)Average Productivity

$$Marginal\ Productivity = \frac{\partial O}{\partial L}$$ (4)Marginal Productivity

The term productivity in this thesis will be used exclusively to denote a ratio of output(s) to input(s) in a specific setting. For example, a simple scenario might be that a factory uses only labour to produce its widgets. Then, it can be said that the productivity of the factory can be measured in terms of the number of widgets it produces divided by its labour use. Issues surround this definition through the potential for this factory to produce widgets that it cannot sell (Goodman, 1985). To avoid such a case, the output measure must be defined in a meaningful manner that takes into account the market value of the item being produced.

The next definition is of efficiency. In economic terms, it can be said that if a business uses more than one type of input (say labour and capital), it should use those inputs in such a ratio that their marginal contributions to the firm's goals are equal. If they are unequal, then the firm would be better off to "trade" one or more units of the input with the lower marginal contribution for the equivalent value of the other input. For example, if a firm is currently operating in a situation where capital and labour are infinitely divisible (a reasonable assumption when labour can be procured by the person hour and capital by the cent), and the

last unit of labour applied added 5% to the previous level of output while the last unit of capital applied added only 2% to the previous level of output, then, assuming that the units of capital and labour were of equal value, the firm would be well advised to replace its capital with labour until the two rates become equal. Therefore, the definition of maximum efficiency is the situation in which the marginal productivity of each input for a given output is identical.

Another required definition is of performance. Performance will be used in this thesis to mean the degree to which the firm's goals are being achieved. In order to narrow "goals" to a workable definition, profitability is assumed to be the retailer's paramount goal. Therefore, performance is equal to profitability.

Profits can be calculated by multiplying sales times average margin. The term used in the literature to differentiate among the aspects of productivity and performance was effectiveness. Effectiveness was specified to be return on investment by Achabal, Heineke and McIntyre (1984) thus distinguishing it from productivity per se. That definition uses investment as part of its makeup which would mean that there would be no difference between performance and capital productivity. Therefore, performance will be specified as being profits constructed from sales and margin. Having established these definitions, it is now possible to make some progress in delineating the existing work in this area.

Level of analysis

Following from **Figure 3**, the first level of distinction among the work in this area is the level of analysis. Several authors (e.g., Ward 1973; Smith and Hitchens 1985; Ratchford and Brown 1985) have addressed the issue of the industry level productivity of various forms

of retailing. The approach has been one of using data readily available from secondary statistical sources to track the industry's productivity over time. Productivity is measured in the form of a production function estimated from the secondary data. This form of productivity analysis is aimed at macro level decision makers and not at store managers. In fact, Ratchford and Brown (1985, p 309) state "Since the results of this study show what happened at the level of the economy, they do not necessarily reflect on the performance of individual retailers or managers." In general, the methods used have hinged upon the fitting of a production function to the data and following the parameters through time. The results indicate that productivity in retailing is increasing, but at a decreasing rate (Ratchford and Brown 1985). Ratchford and Brown (1985) also note in their study (which covers the years from 1959 to 1979) that while their study examined food retailing, other areas of retailing should also be closely examined (p 309).

The next level of analysis is that which is aggregated across firms but disaggregate across statistical areas. Here, an author gathers data from a readily available government source for Standard Metropolitan Statistical Areas (Schwartzman 1971; Ingene 1979, 1982), or political regions (Hall, Knapp and Winsten 1961; George 1966; Bucklin 1978). At this level, the analysis takes the form of assuming that productivity is driven by market conditions and is thus homogeneous throughout each region. The analyst can then determine the covariates of productivity through an examination of the market factors in each region. Common market factor measures have been income, population growth, population density, labour market tightness, annual retail wage rates, and so on. These factors are then correlated with the measured productivity in each area and the signs and weights investigated. The

introduction of this level of analysis signalled the move toward more retail manager oriented information. The results of these studies can be linked to performance in a specific situation, presumably to allow managers to identify their own conditions and act accordingly.

The third level of analysis is at the store or retail unit level. At this level, an author gathers primary data from a firm or firms on the operation of individual stores (e.g., Good 1984; Ratchford and Stoops 1988; Lusch and Moon 1984; Hise, Kelly, Gable and McDonald 1983; Bultez and Naert 1988; Thurik and Kooiman 1986; Thurik and van der Wijst 1984; Doutt 1984, Donthu and Yoo 1995). This information is then used to test relationships among the hypothesised predictors of productivity at a retail unit level. This approach requires primary data from retail stores. Additionally, data collected at this level must contain a certain level of subjectivity. Hise et al (1983) for example, request information from their informants on the number of hours worked and other managerial effort factors. These data can be seen to be mainly subjective in nature.

A fourth level of analysis is at the stock keeping unit (SKU) or product level. Here an author gathers information on products and how well they move through a given store, their profitability and the contribution they make toward profitability (Borin and Farris 1990). The idea being that individual products can then be compared one against the other to determine which are providing the most positive effect on store performance.

The preceding discussion highlights the levels at which this analysis can be conducted: industry, census area, retail unit or SKU. On the one hand, the greater the degree of aggregation, the greater the potential for "data loss" (removal of salient variance due to aggregation). In contrast, the more specific the data are, the greater the potential for

subjective bias (measurement error) entering the collection process. This trade-off must be addressed in any future work in this area and data collection and measurement techniques must be developed which will combat either data loss or bias.

Type of Relationship

The second level of distinction among papers on retail productivity measurement is that of the relationship among the variables. A researcher can either specify the relationship to be deterministic or statistical. Deterministic approaches are demonstrated in the case where an author posits a production function and proceeds to use the data available to estimate the coefficients of the production function (e.g., Ratchford and Stoops 1988; Bultez and Naert 1988; Thurik and Kooiman 1986; Ratchford and Brown 1985; Thurik and van der Wijst 1984; Doutt 1984; Achabal, Heineke and McIntyre 1984; Thurik 1984; Ward 1973; Ingene 1982, 1985, Donthu and Yoo 1995). These production functions are usually based upon the Cobb-Douglas type of function (see equation **(2)**) due to its flexibility and ease of estimation (Varian 1984, p 172). The Cobb-Douglas function has many features which make it appealing as a production function. It fulfils the requirements laid out by economists for any production function and it is easily manipulated to give elegant results (Varian, Chapter 1). For these reasons it is attractive to researchers who wish to specify a function *a priori* and then estimate a known set of parameters. Note that Donthu and Yoo (1995) do not specify a production function per se, but rather use Data Envelopment Analysis (DEA) to examine the ratio of inputs to outputs to determine retail unit efficiency.

A researcher may be interested in more general information about a set of variables than can be provided through estimating a specific function. In such a case, the researcher may prefer to examine correlations between and among the variables in order to get a broader picture of the way in which these variables behave. Several researchers have taken this approach, either through examination of the variable correlations or through regression estimations (e.g., Lusch and Moon 1984; Hise, Kelly, Gable and McDonald 1983; Good 1984). The techniques employed have ranged from stepwise regression of the basic variables (Hise et al) through linear regression of more basic variables and their squared terms (Good) to more complicated combinations of variables (Lusch and Moon). Lusch and Moon, in fact estimated two models, the first was a simple linear model of "value added" (sales margin) regressed on the number of employees. They then introduced additional factors to the model by adding to the initial model terms which were multiplied by the number of employees. The purpose of this was to estimate the marginal impact of each of the added variables to the contribution the number of employees had on value added.

Both of the means of examining the relationship among the variables have their benefits and their problems. In the case of an *a priori* function, if the function is mis-specified to begin with, the estimates may be misleading. A discussion of that possibility is given in Ratchford and Stoops (page 257) where the differences between the estimates for the log-linear and translog functions are cautiously ascribed to inaccuracies in the log-linear parameters due to misspecification of the model form.

Many similar problems exist in the use of linear regression. The assumption of linearity and the statistical assumptions necessary to validate OLS results suggest that this

technique has some of its own potential pitfalls. Hise et al (1983) show that the degree of multicollinearity among the independent variables in their regression is sufficiently low so as to not adversely affect the process of step-wise regression. There were, however, no checks to determine whether the relationship was linear in variables, thus they could also experience the effects noted by Ratchford and Stoops.

In neither approach can the researcher feel entirely confident about his or her results. In the case of a pre-specified function, the danger that the convenient Cobb-Douglas form may in fact be incorrect causes concern, while the linear regression approach also leads to some uncertainty about the results. Clearly, further effort in this area is required.

Independent Factors

Three facts have focussed the attention of researchers on labour productivity in retailing. First, the retail trade accounts for a substantial amount of the work force (approximately 13%: Mason et al. 1993, p 4). Second, the rate of growth of retail labour productivity has been substantially below that of manufacturing firms (.76 percent annually for retail industries versus 1.41 percent annually for manufacturing firms: Lusch and Moon 1984, p 39), and third, early researchers (Takeuchi 1977) found that 55 percent of profit variance in retail supermarket stores was explained by differences in labour productivity.

In light of these three facts it is not surprising that the greatest amount of effort in retail productivity measurement has been in terms of labour productivity. In fact, almost all work that has addressed retail productivity has addressed labour productivity. In addition to labour, other independent variables have generally been included in an attempt to better

explain labour productivity. Examples include descriptions of the product offerings (Thurik and van der Wijst 1984; Ratchford and Stoops 1988), proxies for capital such as capacity (Lusch and Ingene 1979; Good, 1984 - both used square feet of selling space), market factors such as population and income (Ingene 1982; Hise et al 1983), and marketing mix variables (Lusch and Moon 1984).

Table 1 lists a broad selection of the input and output measures that have been employed in this literature. Clearly many factors have been investigated in an attempt to fully describe retail productivity, but just as clearly, never before has a single effort attempted to integrate factors from each class of independent and dependent variables. This is a gap in the research.

Table 1: The Factors Used in Productivity Research

Input			Output		
Heading	Construct	Measures	Heading	Construct	Measures
Labour Factors	Employee Effort	Hours Worked, Full Time Equivalents, Hours Open	Performance	Sales	Dollar Sales, Sales per Square Foot, Turnover, Quantity Sold
	Employee Incentive	Wages Paid, Share Part-Time Workers			
Capital Factors	Physical Size	Linear Feet of Shelf Space, Floor Space, Number of Checkouts, Service Capacity,		Contribution to Income	Gross Margin, Net Margin, Value Added
	Capital Intensity	Dollars Invested, Current Inventory, Value of Facilities, Merchandise Intensity, Capital to Labour Ratio, Level of Technology			
Management Factors	Skill	Age, Education, Marital Status, Number of Children, Annual Income, Experience		Return on Assets	EBIT/ Total Assets
	Ownership	Manager Owned, Franchised, Co-op			
Demand Factors	Competition	Direct Competitors, Secondary Competitors, Location, Advertising Intensity			
	Customers	Income, Mobility, Household Size			
	Economics	Price Charged, Industry Structure, Labour Market Tightness			
Process Factors	Materials	Costs of Goods Sold			
Other	Misc.	Years Store Open, Intermediate Services Used			

Dependent Factors

Achabal, Heineke and McIntyre (1984) suggest that the productivity measures of retailers should be in terms of the extended product "produced" in the retail establishment. That is, the level of service available to the customer, the rate at which shelf stocks can be replenished and so on. Goodman (1985) takes exception to this approach suggesting that no economic output can take place unless that output has value. Drawing on the accepted definition of services as instantly perishable goods, he suggests that the only appropriate measure of productivity is, of necessity, a measure of the retail output. It is interesting to note that in their research Achabal et al (1984) interviewed several retail executives who uniformly supported Goodman's (1985) approach to the problem. While managerial support may not be an acid test of the value of an approach, it should at least be an indicator. Furthermore, it should be noted that productivity (output over input) is a necessary but not sufficient condition for efficiency (maximum output per unit of input) which in turn is a necessary but not sufficient condition for performance (achievement of goals - say profits) (Achabal et al 1984; Goodman 1985). This implies that, contrary to the statements of Achabal et al (1984), any bias in the measurement of productivity through the use of demand based measures (sales, profits, value added, etc.) will not be upward, but downward. This is because, in order for a sale to take place, the actions that Achabal et al (1984) suggest as productivity must have already happened. Thus, any time a sale takes place (incrementing the output variable in productivity), the measures used by Achabal et al (1984), would have been also incremented. In fact, the measures they suggest (ability to replenish stock for example) can happen whether or not sales take place but not vice versa. It should be noted, however,

that the main thrust of the Achabal et al (1984) paper was to identify the fact that changes in measured productivity based upon output can be brought about by either the retailer or the consumer becoming more efficient (Ratchford and Stoops 1988, p 248).

Ratchford and Stoops (1988) get around the problem of selecting an appropriate output in a clever fashion by factoring out the service level provided to the customer through the use of the Ehrlich and Fisher model (1982). The premise of the Ehrlich and Fisher approach is to eliminate the need to measure the service provided since retailing is assumed to be a perfectly competitive market. In a perfectly competitive market the price of the product is equal to the marginal cost, thus the retailer provides exactly the amount of service that the customer is willing to purchase. The customer is willing to purchase the services in return for a lessening of the search costs and other time factors involved in shopping.

Services Sought by Consumers = Services Provided by Retailers
(5) Basis of the Ehrlich and Fisher Model

In this fashion, Ratchford and Stoops are able to eliminate any need to value the services supplied and can model the amounts of labour and products supplied as being related. This approach is very appealing in that it neatly bypasses the question of the appropriate measure of output raised by Achabal et al (1984, 1985) and provides an economic theoretic model of how these factors should be linked. The downside to this approach is that realistic retailers have some degree of locational monopoly power which will allow them to collect extra economic rents from their consumers.

Betancourt and Gautschi (1990) also use the household production function approach to provide support for the value of the services provided by retailers. Their work is not aimed at retail productivity per se, but rather at providing support for the concept that retailers and distributors are providing a service to society for which consumers are willing to pay. The reason the consumer is willing to pay is similar to that given in Ehrlich and Fisher (1982): the consumer has a limited set of resources which must be used to generate the greatest return.

Thus, in accordance with the preponderance of research in the field, the measure of productivity that this thesis will use is one in which the actual output of the retailer is measured. Which output is selected is investigated next.

While Goodman suggests that some aspect of the output of the retailer should be used in the measurement of productivity, he does not select a "best" measure. Value added (usually taken as the net margin on sales) is taken as the numerator in the productivity ratio by Doutt (1984), Ratchford and Brown (1985), Hise, Kelly, Gable and McDonald[2] (1983), Lusch and Moon (1984), Goodman (1985) and Good (1984) as a means of describing the dependent measure in productivity. This approach is appealing since it deals directly with the monetary equivalent value of the utility that the consumers get from using a retailer. This in turn can be suggested to be an indication of the market value of the production of the retailer (Ehrlich and Fisher 1982).

Another measure of output used in the calculation of productivity is total sales, either in dollars or in quantity. Ratchford and Stoops (1988) use quantities, while Hise et al (1983)

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[2]Hise et al examine three separate output measures in their study: sales, contribution and return on assets. This study therefore appears in several categories of output measure used.

and Ingene (1982) use dollars sales, and Thurik and Kooiman (1986) use sales volume. These output measures were regressed directly on the independent measures (Hise et al), divided by input factors and then regressed on the independent measures (Ingene), used as independent measures to explain the input requirements (Ratchford and Stoops) or used in a switching model[3] (Thurik and Kooiman). The advantage of using a sales based measure is the ease with which these data can be collected. The disadvantages have been well described by Achabal et al (1984, 1985) and amount to the fact that measures of productivity based upon sales data cannot distinguish between consumer or retailer driven productivity.

Achabal et al suggest that some other approach to the measurement of productivity is necessary. Their reasoning flows from the concept that changes in consumer demand while a firm has made no changes to its operating procedure should not be reflected in productivity measures. Unfortunately, Achabal et al make no suggestions as to what should be the measure of productivity, rather they leave the issue open for discussion. As was mentioned earlier, their discussion also suggested that a measure of productivity that is based upon sales or any other retail output will be upward biased. Given the understanding that productivity is necessary in the development of capacity, actual output could temporarily exceed the capacity of the retail outlet to produce the required services through self-service from shelves stocked in slower times, but this is unsustainable. Thus estimates of productivity based upon output measures are downward biased, not upward thus neatly eliminating the arguments of Achabal et al.

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[3]The switching model is a disequilibrium model based upon comparing the supply factors with demand factors determining which is the limiting quantity.

Sector Under Study

The grocery trade has been the subject of most of the productivity scrutiny in the literature. Exceptions to this rule include Ratchford and Stoops (1988), who use book stores; Hise et al (1983), who do not define their stores but imply that they are not grocery retailers (". . . nonclothing items in stores located in malls throughout the United States." " . . . average size was slightly over 3,300 square feet" p 26); Lusch and Moon (1984), who study hardware stores and Doutt (1984) who studies fast food retail outlets. All remaining studies of retail productivity discussed here are based upon grocery stores. Some of the most interesting results are replicated across industries. Lusch and Moon (1984), Good (1984) and Ratchford and Stoops (1988) each note that decreasing returns to scale are evident in the largest stores in each of the hardware, grocery and book shop trades respectively. Decreasing returns to scale are discovered when a productivity model has a negatively signed quadratic term and a positively signed linear term. This indicates that productivity is increasing at a decreasing rate - assuming that no operation takes place beyond the maximum of the function.

Since most efforts have focussed on grocery stores, it is of interest to examine another sector of the retail trade to determine whether the same relationships hold. This thesis, therefore studies the health and beauty aids retailing to pursue this investigation.

Types of Measures Used

Most studies of productivity have been based upon objective measures (measures which remain consistent irrespective of who takes them) (see **Table 1** for a list of items

measured in previous research) but some have included subjective measures (measures which may take on different values depending on the measurer) as well. The diversity of measures listed in **Table 1** clearly indicates that not all measures are objective. In cases where subjective measures were used (e.g., relative level of technology, quality of location, level of competition, advertising intensity) generally only single indicators and single informants were used for the measure. This can be a problem from the measurement theory perspective. The biases potentially introduced through this approach could lead to erroneous results in the testing of hypotheses. Further study in retail productivity based on these subjective measures needs to address this issue. This can be done through multiple informants and/or multiple indicators to reduce the measurement error on these variables. In some cases, particularly smaller operations, there may only be one qualified informant.

Issues Surrounding Productivity

Outside the immediate literature on retail productivity lie several other important areas of inquiry. The next sections deal with each of these areas in turn, linking them to the study of productivity research.

Performance Measurement

A series of interesting papers have dealt with issues of performance measurement. The papers by Chakravarthy (1986), Borin and Farris (1990), Child (1974, 1975) and others

have looked at the best means to model or measure performance in a firm. The approaches vary from the strategic[4] (Chakravarthy 1986; Child 1974, 1975) to the operational[5] (Borin and Farris 1990). In all cases, however, the conclusions are that proper performance measurement is an essential ingredient in the manager's approach to guiding an operation. This level of importance transfers to the study of productivity in which the output of the firm leads to performance. This link between output and performance was noted by Dalrymple as early as 1966.

Given the ties between performance and productivity, the proper choice of a measure of performance is essential in the delineation of productivity measures. The preponderance of research in performance and non-performance has found that profitability is the "best" and most sensitive short term performance measure. Best, in this case is defined by its ability to predict non-performance (bankruptcy). See, for example, the excellent literature on bankruptcy prediction starting with Beaver (1965), followed by a series of articles by Altman and various co-authors (1968, 1977, 1981, 1983). In each of these cases, profitability is a significant predictor of bankruptcy. In fact, Beaver (1965) found that ROI was sufficient to predict over 60% of bankruptcies in his study. Altman's successes ranged from around the 60% mark to over 75% although his technique used multiple discriminant analysis while Beaver was restricted to simple discriminant analysis. The work by Altman, particularly his

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[4]Strategic performance can be measured in terms of sustainable competitive advantage leading to higher economic rents.

[5]Operational performance is concerned with altering current operating parameters (e.g., the four P's) to maximise short term profitability.

1968 paper, is, to this day, taken as the standard against which bankruptcy measures are compared.

Inventory Issues

As early as Bucklin (1965), inventory handling and levels were being examined for their impact on retail performance. Since that time, Just-In-Time (Frazier, Spekman and O'Neal 1988) and Quick Response Retail (Larson and Lusch 1990) technologies have come on line in an attempt to reduce the need for a firm to speculate and increase their ability to postpone decisions on inventory. Speculation in inventory terms is the investment of resources in advance in the expectation of future demand. In other words, creating stock prior to its being demanded by the next stage in the retail channel. Postponement, on the other hand, is the ability to maintain resources in reserve until the order is actually placed, thus allowing greater flexibility and reducing the potential for excess stock situations.

More recent developments suggest that inventory has an impact on the manner in which consumers evaluate stores and SKUs. Psychic Stock, "retail display inventory carried to stimulate demand," (Larson and DeMarais 1990, p 30) has been shown to have an impact on sales. There is a clear tradeoff between psychic stock and postponement. The principle of postponement, as operationalized through Just-In-Time or Quick Response (Larson and Lusch 1990), limits stock levels through timely delivery while Psychic Stock implies an increase shelf inventories.

While postponement decreases holding costs, it is not clear what effect it has on the retailer's productivity. If consumers are turning away due to either stock outs or through lack

of psychic stock, then the cost savings inherent in postponement need to be more thoroughly scrutinized.

Strategies

The existence of different strategies and strategic types has been established for some time. Examples of strategic classification include Porter (1980) and Miles and Snow (1978). Porter's (1980) approach was to classify corporate strategies into three basic types: cost leader (a firm that has a production advantage and can therefore generate either higher margins at the same price or compete on price with other, less advantaged firms); differentiation (a firm that produces a product which is unique in the marketplace and thus has the advantage); and focus (a firm which concentrates its efforts on a subset of the market and outperforms its competitors in that subset). Miles and Snow (1978) are less interested in the industry level strategy of Porter and more interested in firm level strategy, suggesting that firms "enact their own environments" (Miles and Snow 1978, p 5). In particular, Miles and Snow identify four archetypal adaptive strategies which they label: Prospector, Analyzer, Defender and Reactor (p 29). These labels are descriptions of the way in which firms conduct their business on a day to day basis.

Recent work has confirmed the existence of these strategic groups (James and Hatten 1993; Cappel, Miller and Wyld 1993) in the retail sector. These strategic groups suggest that there may be more than one way of optimally allocating resources across inputs, suggesting that another examination of retail productivity is in order.

Summary

Examining the variables used and results found in **Table 1** suggests that, overall, the literature on productivity in retailing is still unclear. There are still issues for which contradictory evidence is available. For many of these issues (effect of store size, capital investment and labour effort and incentives for example), the evidence in neither direction can be discounted out of hand. Instead, contradictory conclusions have been reached, sometimes despite similar approaches. The overall area of retail productivity needs another look if these contradictions are to be resolved successfully.

Chapter II

The Productivity Model

This chapter develops a model of retail productivity based upon the findings of the previous research (shown in **Figure 4**) and sets out testable hypotheses from this model. The first section describes the model and relates its relationships to those found in previous work. The second section delineates the hypotheses that the model suggests and the third section defines the measurement of the model.

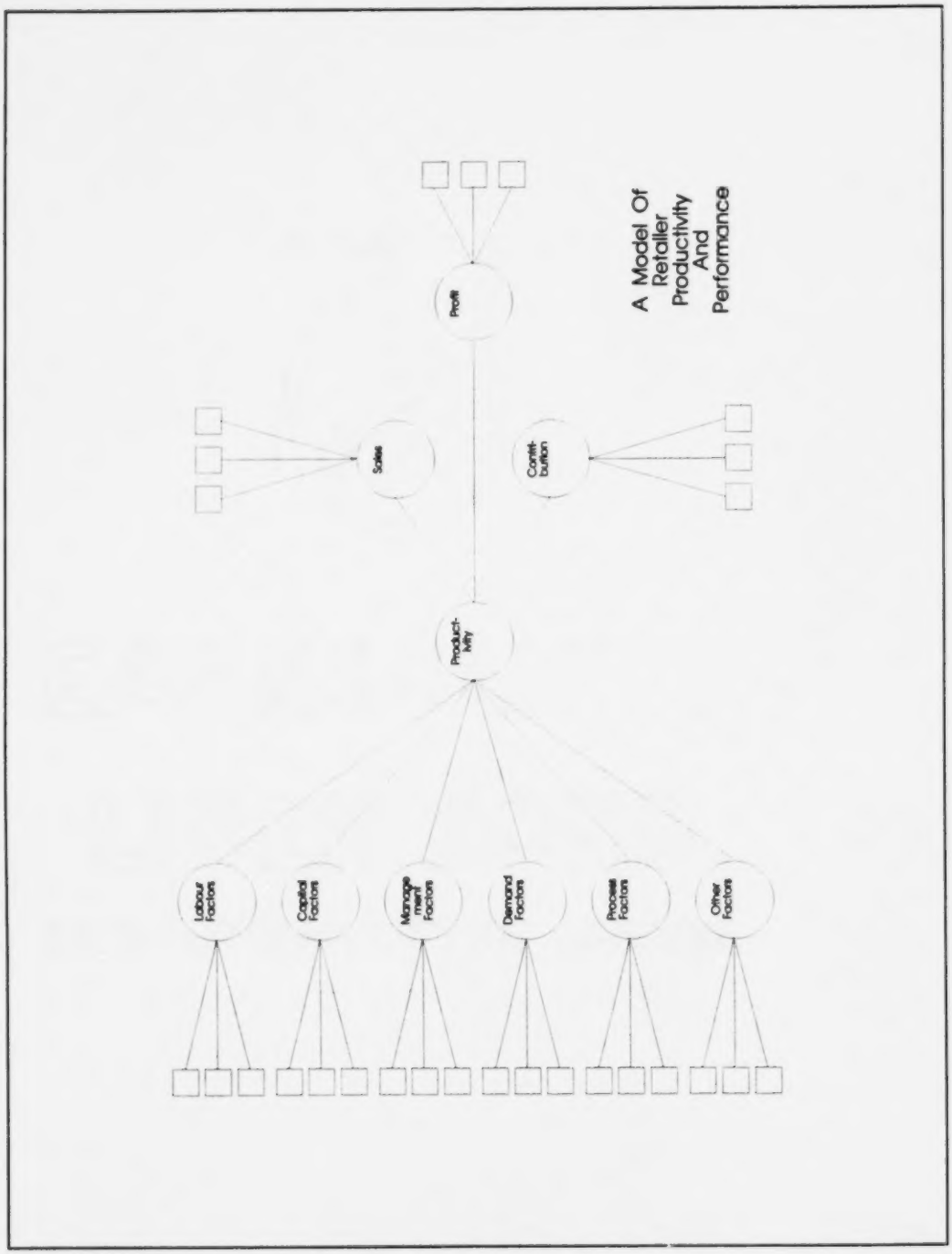
The Model

Figure 4 shows a general model of retailer productivity. The relationships drawn in **Figure 4** are extracted from the combination of previous research in this area although some are adapted for this thesis from their original form. The relationships studied by previous authors and discussed in this section are noted in **Table 1**.

Ward (1973) examined the relationship between the number of persons employed and the volume of goods sold from 1954 to 1970. The study was designed to examine the growth in productivity of retailing as compared to manufacturing. This study focussed on the relationship between an index of employment, the output (sales) and the tightness of the labour market (level of unemployment) in each of the years under study. The study found significant relationships between the labour index and the output (positive), the difference between that year's labour market tightness and the average labour market tightness (negative) and progressing time (negative). Other productivity relationships investigated in

this extensive study were with town size (as a proxy for market size - not significant), shop size (positive) and income (positive).

Figure 4 A Model of Retailer Productivity and Performance



Thurik (1984) finds that the productivity of floorspace increases with the cost of the floorspace but that the coefficients (elasticities) vary widely with the goods sold in the shop. Other findings include that the efficiency of the floorspace in shops does not change with the environment in which the shop operates (size of shopping centre and size of town), that the relationship between labour and sales is linear, that part-time labour in service intensive shops increases labour productivity but has no effect on self-service situations and that labour productivity increases with the wage rate but the increase varies widely with goods sold.

Still (1983) finds no relationship between part-time versus full time employment and the workers' commitment and, by implication, productivity in the work place. The study examined "211 newly employed female sales people (140 full time and 71 part time)" (p 64) in three large retailers in Sydney, Australia. Commitment itself was measured using a 14 item scale which included questions on the employees' sense of belonging, their willingness to defend the organisation against criticism and their loyalty to the firm.

Good (1984) used the following equation in his study of retail productivity

$$\frac{Value\ \ Added}{Man\ \ Hour} = \beta_0 + \beta_1(Space) + \beta_2(Space)^2 + \beta_3\left(\frac{Sales}{SqFeet}\right) + \beta_4(Co\text{-}op) + \beta_5(Tech) + \beta_6\left(\frac{Man\ \ Hours}{SqFeet}\right)$$

Note that the signs in the equation are those that were found in the study. All β's are significant at the 99% confidence level. Note as well, that the negative sign to β_2 indicates that the function is an inverted U shape - one that indicates decreasing returns to scale. The term "Tech" in the equation represents a dummy code which is one when the manager of the operation felt that his or her store's technology was worse than that of the average grocery

store and zero otherwise. Thus, the negative sign implies that higher technology is better. The appearance of "Man Hours" on both sides of the equation is a cause for some concern, although the only effect is to bias the betas upward.

Dalrymple (1966) found that of mark downs, rent, publicity, sales volume, stock turns and average sale size, only sales volume was significant in predicting profits. There is a potential that the insignificance of some of the independent factors in Dalrymple's study may be due to multicollinearity as we might expect several of these measures to move consistently together (e.g., mark downs, publicity and stock turns for example).

Hise, Kelly, Gable and McDonald (1983) get interesting results which contradict some of the other work. Their findings are shown in **Table 2** and indicate that for some versions of productivity (contribution income, and return on assets, but not sales), environmental factors in the form of competition measures do play a part. It should be noted that some of the results of Hise et al are suspect as they have used categorical variables in some cases as interval variables. Marital status, for example was coded in terms of increasing stability.

Table 2: Review of Results

Variable		Ward (1973)	Thurik (1984)		Hise et al, 1983		
		Labour Index	Sales/ Sq Ft	Sales/ Emp	Sales	Contribution Income	Return on Assets
Store Manager Variables	Age				ns	ns	ns
	Annual Income				ns	ns	ns
	Marital Status				ns	ns	+
	Number of Children				ns	ns	ns
	Educational Level				ns	ns	ns
	Hours Worked per Week				ns	ns	ns
	Experience in Retailing				ns	ns	ns
	Experience in Present Position				-	-	-
	Experience with Present Employer				+	+	ns
Environment	Labour Tightness	-					
	Time	-					
	Wage Rate			+			
	Location						
	Mobility						
	Congestion						
Demand Factors	Primary Competitors				ns	-	-
	Secondary Competitors				ns	ns	+
	Retail Saturation						
	# Small Shops						
	Mall Size		ns		ns	ns	ns
	Market Size	ns	ns		ns	ns	ns
	Income	+					
	Transaction Size						
	Household Size						
	Mark Downs						

Variable		Ward (1973)	Thurik (1984)		Hise et al, 1983		
		Labour Index	Sales/ Sq Ft	Sales/ Emp	Sales	Contribution Income	Return on Assets
Store Variables	Store Size	+			-	-	-
	Store Size^2						
	Service Capacity						
	Fixed Assets				+	ns	-
	Capital/ Labour						
	Technology						
	Cost/Sq Ft		+				
	Inventory Levels				+	+	+
	Years Store Open				ns	ns	ns
	Store Type						
	Ownership						
	Employees per Store		+		+	+	+
	Hours Worked						
	Man Hrs/Sq Ft						
	# Part-Time Emp.			+			
	Volume Sales	+					
	Price						
	Publicity						
	Stock Turns						
	Sales/Sq Ft						

Table 2: Review of Results (Cont'd)

Variable		Still (1983)	Good (1984)	Dalrymple (1966)	Ratchford & Stoops (1988)
		Commitment	Value Add/ Man Hour	Profits	Labour
Store Mngr Variables	Age				
	Annual Income				
	Marital Status				
	Number of Children				
	Educational Level				
	Hrs Worked/Week				
	Exp. Retailing				
	Exp. in Present Position				
	Exp. with Present Employer				
Environment	Labour Tightness				
	Time				
	Wage Rate				
	Location				
	Mobility				
	Congestion				
Demand Factors	Prime Competitors				
	Second Competitors				
	Retail Saturation				
	# Small Shops				
	Mall Size				
	Market Size				
	Income				
	Transaction Size			ns	
	Household Size				
	Mark Downs			ns	

Variable		Still (1983)	Good (1984)	Dalrymple (1966)	Ratchford & Stoops (1988)
		Commitment	Value Add/ Man Hour	Profits	Labour
Store Variables	Store Size		+		-
	Store Size^2		-		
	Service Capacity				
	Fixed Assets				
	Capital/ Labour				
	Technology		+		
	Cost/Sq Ft			ns	
	Inventory Levels				
	Years Store Open				
	Store Type				s
	Ownership				
	Employees per Store				
	Hours Worked				
	Man Hrs/Sq Ft		-		
	# Part-Time Emp.	ns			
	Volume Sales			+	
	Price				
	Publicity			ns	
	Stock Turns			ns	
	Sales/Sq Ft		+		

Table 2: Review of Results (Cont'd)

Variable		Doutt (1984)	Lusch & Moon (1984)	Ingene (1982)	Summary
		Value Added	Value Add/ Employee	Sales/ Employee	Various
Store Manager Variables	Age				ns
	Annual Income				ns
	Marital Status				ns/+
	Number of Children				ns
	Educational Level				ns
	Hrs Wrked/Week				ns
	Exp in Retailing				ns
	Exp in Present Position				-
	Exp with Present Employer				+/ns
Environment	Labour Tightness				-
	Time				-
	Wage Rate		-	+	+/-
	Location		s		s
	Mobility			+	+
	Congestion			-	-
Demand Factors	Prim. Comptitors				-/ns
	Sec. Comptitors				ns/+
	Retail Saturation			-	-
	# Small Shops			+	+
	Mall Size				ns
	Market Size				ns
	Income			+	+
	Trans Size				ns
	Household Size			+	+
	Mark Downs				ns

Variable		Doutt (1984)	Lusch & Moon (1984)	Ingene (1982)	Summary
		Value Added	Value Add/ Employee	Sales/ Employee	Various
Store Variables	Store Size		+	-	+/-
	Store Size^2		-		-
	Service Capacity	ns			ns
	Fixed Assets	+			+/-/ns
	Capital/ Labour		+	+	+
	Technology				+
	Cost/Sq Ft				+/ns
	Inventory Levels		s		+/s
	Years Store Open				ns
	Store Type		s		s
	Ownership	ns	s		s/ns
	Employees per Store				+
	Hours Worked	+			+
	Man Hrs/Sq Ft				-
	# Part-Time Emp.				ns/+
	Volume Sales				+
	Price		-		-
	Publicity		s		ns/s
	Stock Turns				ns
	Sales/Sq Ft				+

Lusch and Moon (1984) find significance in all the relationships they study. Since all their variables were coded as dummy variables multiplied by the number of employees in the store, some of the interpretation of the results is less than clear. With that in mind, they find that place (an environmental factor defined as one of six possible locations varying from downtown to free standing with no adjacent stores) plays a role as do store type (lumber versus hardware stores) and store ownership (the legal form of ownership), that price is negatively related to value added as are wage rates, that the capital (represented, for example, by investment in cash registers, shelving, or lighting) to labour ratio is positively related to value added, that inventory and advertising are related to value added but in an uncertain fashion and finally that scale of the store (size) is related in a quadratic function to value added (has a U-shaped cost curve). While some of these results are strikingly different from other work, it should be noted that this study was done in the hardware industry while most others were done in the food sector which is a possible source of the variation.

Ratchford and Stoops (1988) find relationships between labour requirements and type of goods sold (in agreement with Thurik 1984) and a surprising negative relationship with size of store measured in shelf space. The result is surprising since all other studies which found a significant relation between productivity and size found a positive relationship. This negative relationship may wash out with the interactions between size and type of goods sold and time. They also note some interactions between the month of the data and the type of goods sold. Time itself (the month in which the data were collected) is a significant main effect in their results. Their results differed substantially between the log-linear function and

the translog function they fit. For example, in the log-linear function, shelf space has a positive relationship to labour requirements (as one would expect).

Doutt (1984) finds that only capital and labour in terms of insured value of facilities and hours worked per week are significant in predicting value added. Other variables not significant were service capacity and ownership type (franchised versus owner operated).

Ingene (1982) regressed ten variables on sales per employee and found the following significant results: capital to labour ratio (positive), average store size (negative), retail saturation (negative), retail wages (positive), number of small shops in competition (positive), income (positive), household size (positive), mobility (positive) and congestion (negative). Note that, once again, the same variable (in this case number of employees) appears on both sides of the equation.

The assessment of the previous work suggests several points of inquiry and indicates others that have been adequately investigated. To this end, a simplified model of productivity is presented in **Figure 5**. This model reflects the uncertainty that is still present in the literature. This uncertainty is detailed in the subsequent paragraphs.

Figure 5 A Simplified Model of Retailer Productivity and Performance

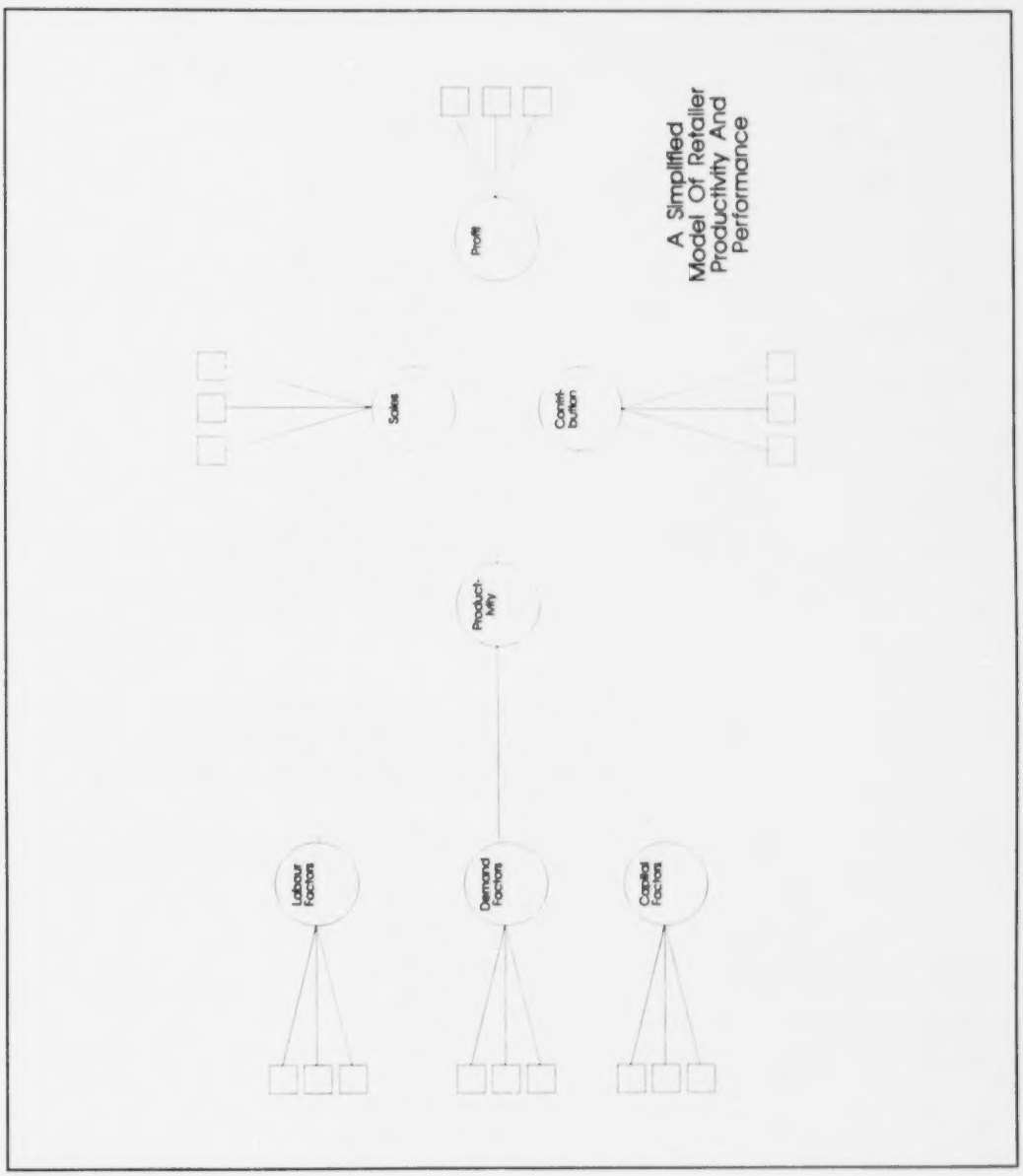


Figure 5

First, there is some uncertainty regarding the effect of store size, a capital factor, on various measures of productivity. The literature that addresses that question presents significant results in opposite directions. Therefore, this is a factor which bears investigation.

Another store size aspect which has generated mixed response is the shape of the relationship. Three studies show the relationship as being U-shaped in cost while others test for a quadratic term, but find only a linear relationship.

Store size is also represented through the measure of fixed assets which shows all three possible signs: positive, negative and not significant. This negative relationship, however, is in a regression in which the dependent variable is profit divided by assets, which introduces a bias into the parameter estimation since size and assets tend to be related.

The three preceding questions lead to a set of hypotheses which are given as hypothesis 1:

H1a: Store size will be positively related to productivity of all inputs.

Hypothesis 1a is suggesting that there are positive returns to scale for store size. That is, the larger the store, the lower the required level of inputs per unit of output.

H1b: Store size will be related to productivity in a quadratic form.

Hypothesis 1b is based upon the notion that retailers are operating in a perfectly competitive, or nearly so, business environment. If this is the case, then there can be no firms which are

operating at a scale too large to be sustained. Other stores will enter the market on a smaller scale and either drive the inefficient store out of the market or force it to adjust its inputs so that it is operating on downward sloping part of the long run cost curve.

The null hypotheses for each of hypotheses H1a and H1b are shown as H01a and H01b below.

H01a: Store size has no impact on productivity.

H01b: Store size is not quadratically related to productivity.

The level of investment in the store has also raised some questions in the literature. Level of investment is represented by such measures as capital to labour ratio, rental cost per square foot, level of inventory and level of technology. These items represent an indication of how heavily a retail store owner has committed his or her funds to the operation. In order for a store with a high level of capitalization to succeed, it would need to be very productive to meet or exceed the opportunity costs of the investor. That is, the return on investment must be larger than that attainable from other potential investments. From this we get Hypothesis 2:

H2: The higher the level of capital investment in a store, the higher the productivity of the store.

The null hypothesis for hypothesis H2 is:

H02: There is no relationship or a negative relationship between capital investment and productivity.

In the area of demand factors, the number of competitors close at hand is sometimes significant in predicting productivity and sometimes not. The amount of competition that can be borne by a market is related to the size of the market itself, thus competition should be related to productivity if market size factors are controlled. This is expressed in Hypothesis 3:

H3: For a given market size, the more competitors a retail store faces, the lower its productivity will be.

Hypothesis three is more complex than at first it seems. If both the retail and capital markets are perfectly competitive, then hypothesis three will be rejected as investors can better utilize their money in more efficient operations, perhaps in different markets. If, however, there are some extra economic rents extracted by the retailers, perhaps due to locational advantages, then there will be room for variation in productivity within market sizes.

The null hypothesis associated with H3 is as follows:

H03: There is no relationship, or a positive relationship between market size and productivity.

A final area of contention in the literature is that of the effect of wages on productivity. Both positive and negative effects have been noted for wage rates and at least one study warns that the effects may be an example of reverse causation (Lusch and Moon, 1984) in that more productive stores can afford better employees who are more committed and therefore the relationship is one of effect and cause. Irrespective of the direction of causality, it is still of interest to determine whether higher wages are related to higher productivity and this leads to Hypothesis 4:

H4: The higher the wages paid to employees, the more productive the store.

The null for hypothesis H4 is:

H04: There is no relationship or a negative relationship between employee incentives and productivity.

The form of the relationships in productivity is also of some question. Cox (1948 p. 433) stated that: "there can be no best method of measuring productivity. The best measure

will vary with . . . the purpose of the researcher". While the choice of output is usually left up to the researcher in light of the question being asked, it would seem that identifying some basic relationships in the productivity to performance process would be helpful to future researchers. Thus, the remaining hypothesis tests the form of the model as opposed to the specific relationships between constructs in the model.

Hypothesis 5 is that performance is based upon both productivity and efficiency. It suggests that the various inputs in a retail setting combine to form a level of efficiency which can then be translated into the outputs of the store. That is, the final output of the store hinges upon all inputs and thus a latent construct is introduced into the model between the visible inputs and the visible outputs. Hypothesis 5 examines the validity of this construct.

H5: The inclusion of the construct termed productivity in the model improves the fit of the model.

In the case of hypothesis H5, the null is that this form of the model is no better than the null model.

This hypothesis is based on the concept that there are several, interdependent aspects working together to determine the productivity of any given retail outlet. These aspects are all funnelled through one common link - the retail manager. The retail manager makes decisions regarding the way in which the resources at his/her disposal are to be utilised. These decisions (as shown in **Figure** 1) come to a confluence through the management process and result in the productivity of the operation.

Previous analyses have ignored this aspect and have compared productivity (itself a ratio of a selected output to a specific input) directly with various inputs, sometimes the same input which is the denominator for the productivity measure. Such an approach ignores the contribution of the retail manager who makes the critical decisions which govern the productivity and thus performance of the operations.

Including the variable "productivity" as a latent construct in the model, as suggested by hypothesis 5, is a suggestion that there is some aspect of the input to output relationship which is not extracted in the usual manner. That is, the relationship is not something which is entirely based upon the inputs available, there are other factors, related to the inputs, which are necessary to explain the relationship between input and output.

This hypothesis can be tested only in terms of a structural equation model. No other means exists to determine whether the inclusion of this latent construct makes sense.

Chapter III

Method and Data Requirements

Previous studies in retail productivity has used various techniques to test hypotheses. Most common among these are analysis of variance (ANOVA) and regression. ANOVA partitions the variance in the intervally scaled dependent variables of a data set according to a selected, independent nominal variable or set of variables (e.g., type of store Thurik and Kooiman, 1986) and compares the variance within groups defined by the nominal variables to that between the groups defined by the nominal variables. The ratio of the two variances, divided by their degrees of freedom is distributed as an F distribution. This allows the researcher to assess whether there are significant differences between group means and the overall mean of the data set.

With regression, both the dependent and independent variables are intervally scaled and the researcher examines the amount of variance in the dependent variable that can be captured through some linear combination of the independent variables. Once again, an F ratio can be calculated in which the researcher examines the ratio representing the amount of variance captured by the model compared to that which remains unexplained in the error terms each corrected for degrees of freedom.

In neither regression nor ANOVA can the model incorporate variables that are not either directly measured themselves or measured by a scale constructed from directly measured variables. That is, there is no opportunity to include second order factors which might explain relationships among variables due to phenomena that cannot be measured themselves. In addition, when constructing scales to represent phenomena, the scale contains

some error. The level of this error, or rather its inverse is represented by the measure of the scale's reliability. More reliable scales are more desirable as they indicate a reduction in measurement error, but regression makes no use of the information available on the scale's reliability.

Finally, while regression will allow the researcher to establish the relationship between each independent variable and the dependent variable, it does not allow the researcher to test the validity of the model. It is possible to examine the model for multi-collinearity by looking at the ratio of the eigenvalues of the design matrix, but this, in itself, does not assess the degree to which the independent variables are different from one another.

A technique which will allow all of these aspects to be included and tested is structural equation modelling (SEM). SEM (e.g., LISREL: Joreskog and Sorebom 1989) can be represented by three equations which represent, in order, the structural equation model (equation (**7**)), the measurement model for y (equation (**8**)), and the measurement model for x (equation (**9**)) (Joreskog and Sorebom 1989 pp 1-2).

$$\eta = B\eta + \Gamma\xi + \zeta \qquad \textbf{(7)}$$ Structural Equation Model

$$y = \Lambda_y\eta + \epsilon \qquad \textbf{(8)}$$ Measurement Model for Y

$$x = \Lambda_x\xi + \delta \qquad \textbf{(9)}$$ Measurement Model for X

The variables in these equations are defined as follows:

y a p x 1 vector of observed dependent or response variables.

x a q x 1 vector of observed independent variables, covariates or input variables.

η an m x 1 random vector of latent dependent (endogenous) variables.

ξ an n x 1 random vector of latent independent (exogenous) variables.

ϵ a p x 1 vector of measurement errors in y.

δ a q x 1 vector of measurement errors in x.

Λ_y a p x m matrix of coefficients of the regression of y on η.

Λ_x a q x n matrix of coefficients of the regression of x on ξ.

Γ an m x n matrix of coefficients of the ξ variables in the structural relationship.

B an m x m matrix of coefficients of the η variables in the structural relationship.

ς an m x 1 vector of equation errors in the structural relationship between η and ξ.

The assumptions the model makes are that:

ϵ is uncorrelated with η

δ is uncorrelated with ξ

ς is uncorrelated with ξ

ς, ϵ, and δ are mutually uncorrelated

Covariance matrices

$Cov(\xi) = \Phi(n \times n)$

$Cov(\varsigma) = \Psi(m \times m)$

$Cov(\epsilon) = \Theta_\epsilon(p \times p)$

$Cov(\delta) = \Theta_\delta(q \times q)$

The matrix B has zeros in the diagonal, and I - B is required to be non-singular.

LISREL has the useful property that submodels of the full LISREL model can be developed in which the result is a factor analysis (shown in equation **(10)**), or a multiple regression model (shown in equation **(11)**).

$$x = \Lambda_x \xi + \delta \qquad \textbf{(10)}\ \text{Factor analysis model}$$

$$y = \Gamma x + \zeta \qquad \textbf{(11)}\ \text{Multiple Regression Model}$$

In addition, the errors ζ are related to the reliabilities of the constructs η. That is, the reliability of the construct η_a (where a represents any construct), is 1 - ζ. Thus, we can see that all hypotheses (with the exception of H1b) can be tested with a single method, in fact, in a single step. This assumes that the data are well behaved and that the suggested model fits reasonably well. Should this not be the case, the resulting estimates may be inaccurate or may not converge at all. In such a case, the analysis will have to be conducted on parts of the model independently.

Other disadvantages to the SEM approach include the fact that even simple models can be difficult to interpret and that the SEM approach cannot deal with non-linear relationships. This means that hypothesis H1b will have to be tested in another fashion.

Finally, LISREL cannot deal with nominal data, meaning that if the three groups of data are not homogeneous, they cannot be separated in a single LISREL model. Thus, should the data prove to be different across chains in Canada and between the Canadian chains and the New Zealand chemists, then at least some of the analysis will have to be done using the traditional methods of ANOVA with covariates or regression.

The data requirements to properly implement a SEM include homoscedastic and normally distributed data. Developments in SEM (Anderson and Gerbing 1988 p 413) suggest that these requirements have been substantially relaxed due to the use of a weighted least squares approach to parameter estimation. Additionally, new model "goodness of fit" indicators are less sensitive to sample size and non-normality of the data. In order to take advantage of these abilities and to still ensure good measurement properties, the model has to be constructed in two stages (Anderson and Gerbing 1988). First a measurement model of the constructs should be developed and tested. Once that has been done, the second stage of testing the structure of the model can be performed.

Data Collection Process

This study was designed to be carried out in three steps. The first was to pretest the design of the instrument on the first Canadian chain. In that step, the instruments were first "vetted" by a manager of the organisation, then were produced and sent to 101 stores in the chain - this represented 100% of the stores in the co-operating manager's area of responsibility. In addition to the instruments, this chain provided detailed information from

their Management Information System (MIS) which allowed comparisons between the data collected from the instrument and accurate data from the firm's accounting records.

The survey data and the "hard" MIS data could then be compared to verify that the questions in the instrument were extracting the correct information and that error rates were low.

The second step was to repeat the survey in a second chain with the redesigned instrument (taking into account the information from the pre-test and the vetting performed by a manager from the second Canadian chain). In this case it was possible to collect a limited amount of information from the corporate MIS in order to verify the accuracy of the data collected through the instrument.

The third step was to implement the study on a large scale using the final version of the instrument to collect data on a large number of operations in order to perform all analyses. This was carried out in New Zealand using a mailing list of members of the New Zealand Pharmaceutical Association.

The three step procedure ensures that a solid instrument is used which accurately reflects the situation as seen by each respondent. It also ensures high response rates by improving the clarity of the instrument.

Operationalising the Measures

Measures Used In This Study

The bases for measuring each of the constructs of interest have been described in the previous chapter. Operationalising those constructs so that they were suitable for use in this

study required some refinement of the original measures. Given the participating groups, some alterations to the design of the measures were necessary to reflect different terminology, different business practices and different product lines and offerings. Pretests of the original measures indicated that several of them were unsuitable in their original form.

The subjective measures for sales and margin were developed specifically for this study and were not from previous work. The measures for sales and margin were designed around the families of products that the operations offered. These tended to be classifiable into three categories for each of the groups studied (Chain 1, Chain 2 and the New Zealand Chemists) and thus these measures remained consistent across all three chains.

Measures of store size, labour use, labour incentive, and opening hours were also developed specifically for this study. These were based mainly upon a series of questions which requested the respondent to reply with a number representing that aspect of their operation. That is, one question asked the respondent for the size of the store (in appropriate units - square feet in Canada, square metres in New Zealand), another asked the number of full time employees on staff, yet another asked for the number of part time employees, while a fourth asked for the number of hours the store was open per week. These data are expected to be accurate for the most part as the respondents were the owners of the operation and could be expected to know their operation intimately.

Measures of the other factors were based upon existing, tested scales in the productivity literature. In particular, estimates of competition, environmental capacity, environmental conflict (competition), environmental diversity, environmental dynamism, and environmental interdependence were all drawn from a study by Achrol and Stern (1988) in

which they were looking at the effects of the environment on the way decisions were made in marketing channels. Other measures were drawn from studies by Dwyer and Welsh (1985) and John and Weitz (1989) - environmental forces and environmental uncertainty respectively.

None of the original scales survived the pretesting intact. The final versions of the scales can be seen in the sample instruments in Appendix I. In some cases, the scales were radically changed, while in others, the changes were cosmetic. Some of the changes were things like changing the term "speculative buying" to "deal buying" from the Dwyer and Welsh (1985) scale and changing the phrase "price competition" to "competition based on price" to agree with the other competitive stance questions, also in the Dwyer and Welsh scale. Since the firms under study in Canada were franchised, the suppliers for these operations were strictly the franchisers. As a result, any reference to alternate suppliers, or focal suppliers (as in the Achrol and Stern environmental capacity scale) had to be removed. The final scales that resulted from the pretests and their alphas as well as the original scales, their sources and their alphas can be found in Table 10.

Specific Measures

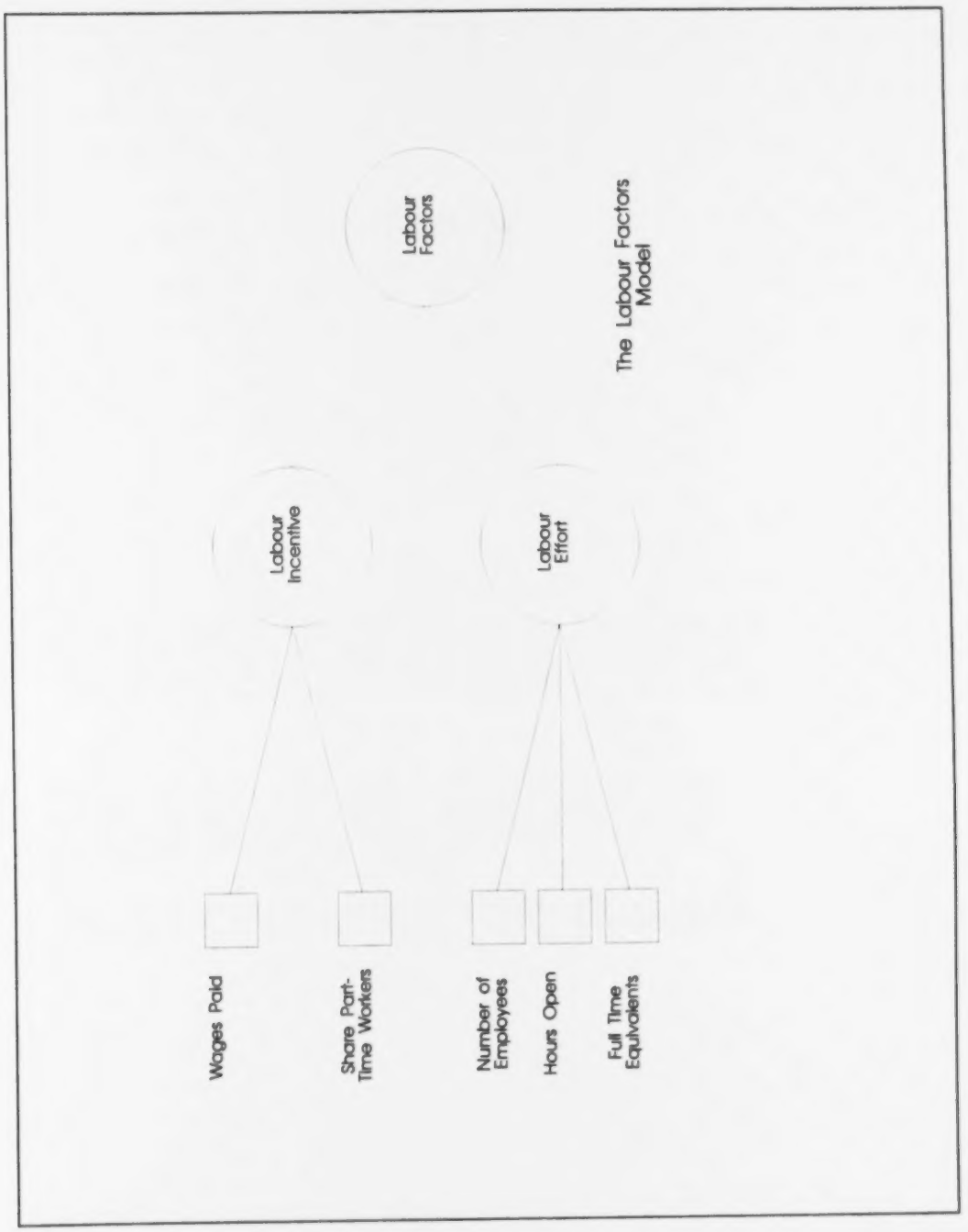
This section of the chapter is broken out into subsections following the model in **Figure 5**. The subsections flow as in the model from left to right, starting with the inputs and proceeding to the outputs. The instrument itself is delineated in each of the sections with the individual questions and scales given in each case.

Inputs

Labour Factors

Table 1 indicates that two areas of labour have been studied: labour effort and incentive. They are also the most commonly used basis upon which to formulate productivity (labour productivity). Labour factors are measured with respect to labour effort expended in support of the operation. Labour effort is measured in terms of number of employees, number of full time equivalent employees, and the number of hours the operation is open for business. This set of measures is associated with the construct of labour effort. They are also measured in a way to reflect the level of commitment to the operation by the workforce. Thus, in order to measure labour input properly, the measurement model is shown in **Figure 6**. The labour factors scale is shown in Table 3.

Figure 6 The Labour Factors Model



Note that the literature indicates that there is uncertainty surrounding labour incentive, so that portion of the model is tested independently of labour effort. Labour incentive is measured by wages and benefits paid to the employee.

Measures

Labour effort is measured with the question in section II part A number 1: How many people does your store employ? Labour incentive is measured with the question in section II part A number 6: What is the approximate hourly value of wages paid to your employees?

Table 3: Labour Factors Scale

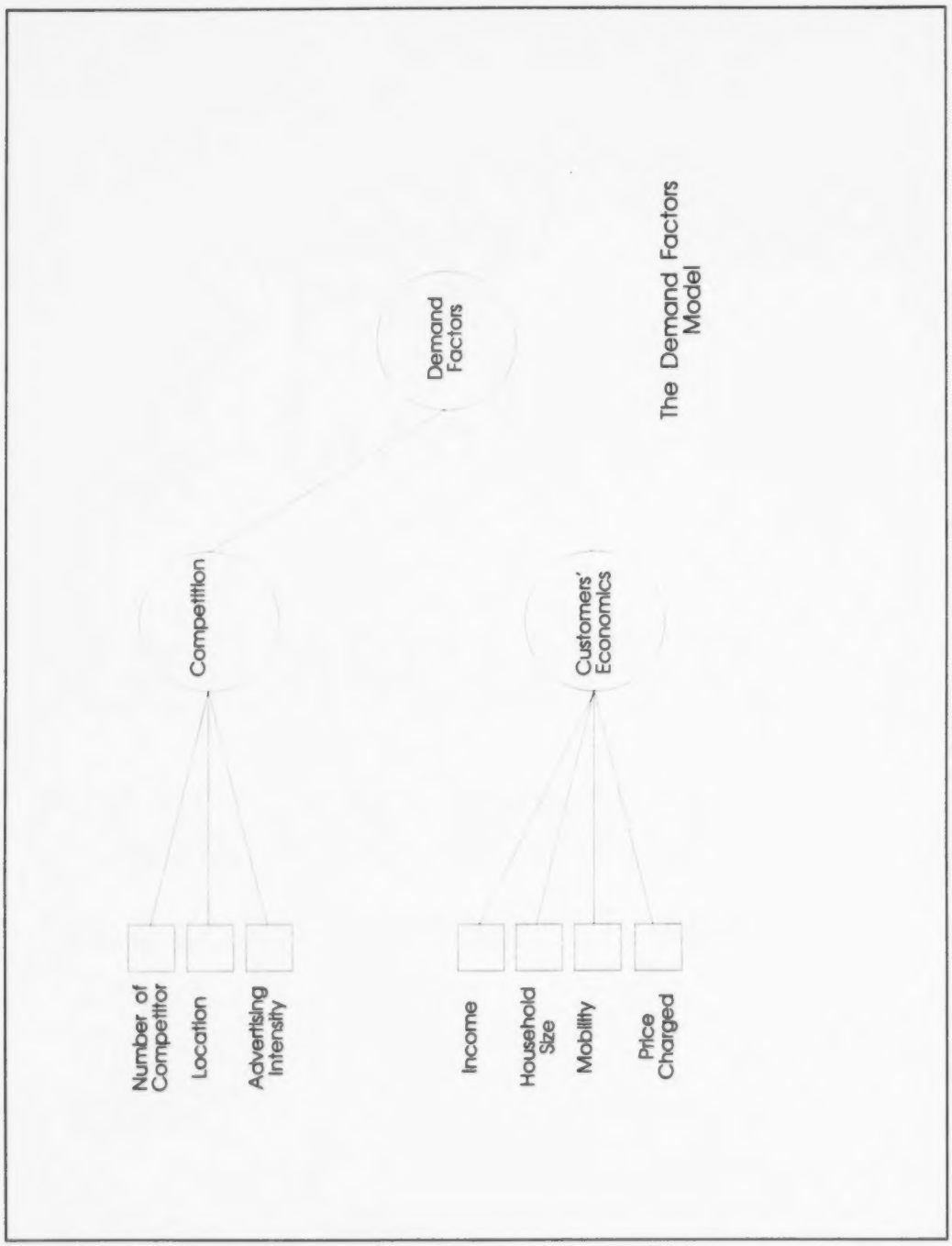
Items	Instrument Item
Number of employees	Section II, Part A, 1
Management team	Section II, Part A, 7
Number full time employees	Section II, Part A, 4A
Number part time employees	Section II, Part A, 4B
Wages	Section II, Part A, 5

Demand Factors

In the area of demand and demand measurement, there are two sub-factors: competition and customers economics. These items are drawn in **Figure 7**. The measures used here include the income of the customers of the retail outlet, the number of people in each household, the household mobility and the price charged. The other element of demand

factors are the competitive factors: the number of competitors in the business area and the location of the retail outlet. Location represents factors such as when the customer would be patronizing the retail outlet (during or after working hours - downtown versus suburban).

Figure 7 The Demand Factors Model



Measures

To measure the demand factors, the instrument included the following seven point Likert scaled items as shown in Table 4:

Table 4: Demand Factors Scales

Items	Instrument Item	Competition	Customer
Deal Buying	Section I, Part A, 3	✔	
Price competition	Section I, Part A, 5	✔	
Location Competition	Section I, Part A, 6	✔	
Selection Competition	Section I, Part A, 7	✔	
Quality Competition	Section I, Part A, 8	✔	
Service Competition	Section I, Part A, 9	✔	
Advertising Competition	Section I, Part A, 10	✔	
Overall sales trend	Section I, Part A, 1		✔
Business cycle	Section I, Part A, 2		✔
Declining demand	Section I, Part A, 4		✔
Stable/Volatile volume	Section I, Part C, 1		✔
Inaccurate/Accurate Projection	Section I, Part C, 2		✔
Unpredictable/Predictable	Section I, Part C, 3		✔
Growth potential	Section I, Part F, 1		✔
Demand for house brands	Section I, Part F, 2		✔
General consumer demand	Section I, Part F, 3		✔
Demographic characteristics	Section I, Part D, 1		✔
Preferred products	Section I, Part D, 2		✔

Items	Instrument Item	Competition	Customer
Product value preferences	Section I, Part D, 3		✔
Comment on new products	Section I, Part G, 1		✔
Comment on items not carried	Section I, Part G, 3		✔
Comment on advertised items	Section I, Part G, 4		✔
Comment on environment	Section I, Part G, 5		✔
Comment on sale items	Section I, Part G, 6		✔

Capital Factors

There are two aspects to the way capital in retailing is examined in the literature. These are through physical size and capital intensity. Physical size is measured through linear feet of shelf space, floor space and number of checkouts. Capital intensity, on the other hand, is measured through the total dollars invested in the retail outlet, the level of inventory maintained, the value of the facilities used, the capital to labour ratio and the amount of technology in place. This construct is drawn in **Figure 8**. The scales for capital factors are shown in Tables 5 and 5.

Figure 8 The Capital Factors Model

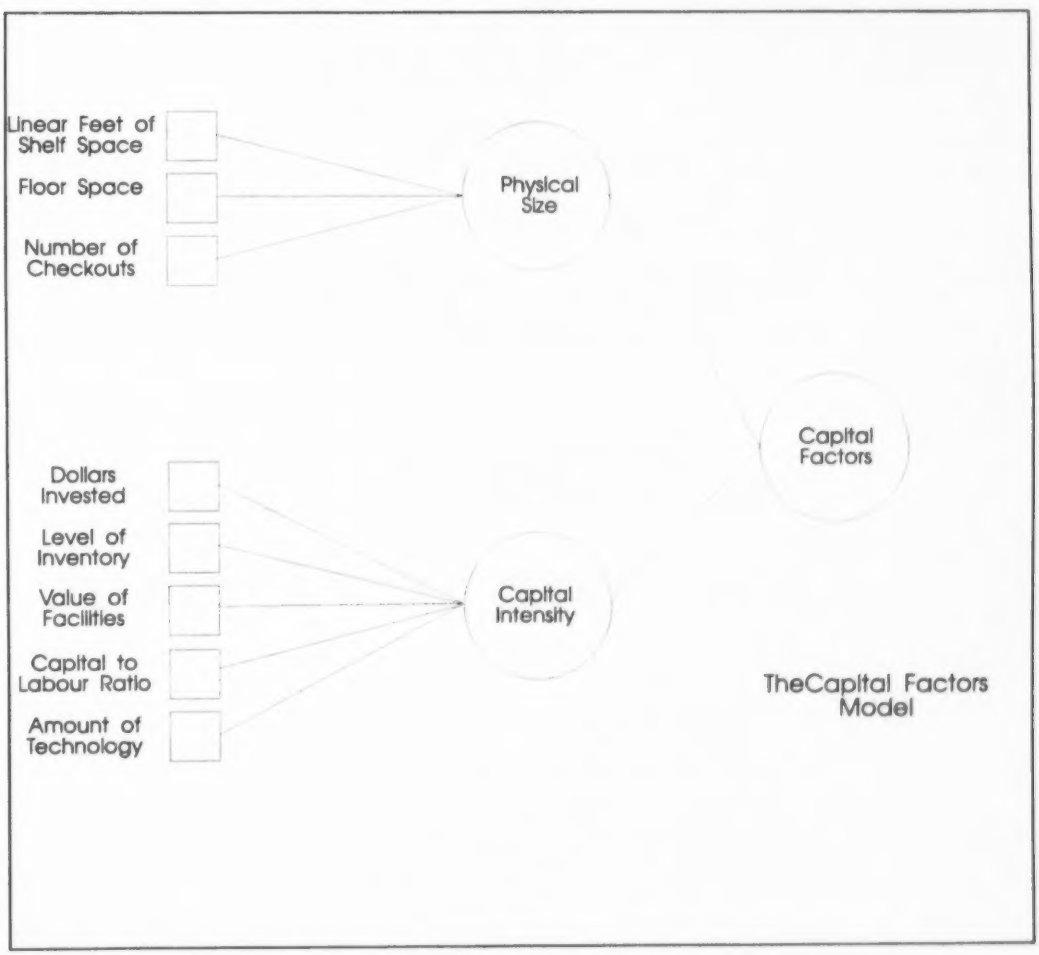


Table 5: Capital Factors Scale - Intensity

Items	Instrument Item
SKU's in cosmetics	Section III, Part A, 3
SKU's in total front store	Section III, Part A, 4
Value of facilities	Section III, Part A, 1
Amount invested in store	Section III, Part A, 2
Value of inventory total front store	Section III, Part A, 7
Value of inventory cosmetics	Section III, Part A, 8

Table 6: Capital Factors Scale - Size

Items	Instrument Item
Total Floor Space	Section II, Part A, 1
Number of Checkouts	Section II, Part A, 8

Outputs

The outputs from the model are presented here. All of the outputs are in one drawing: **Figure 9**.

Sales

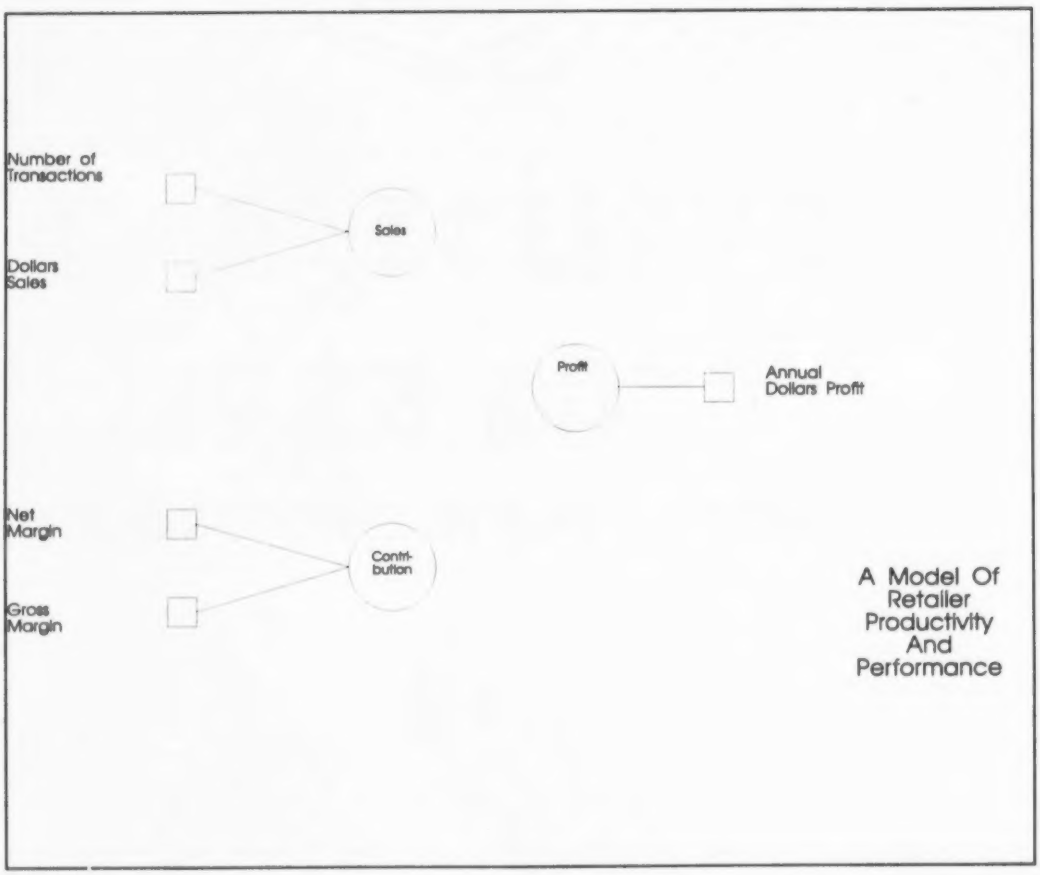
Sales is an output of the retailer and, as such, must be measured to get at productivity. Sales has been measured in terms of the total dollar sales, and the number of

transactions made in the store over a given week. The scale used for sales is shown in the table below, Table 7.

Table 7: Sales Factors Scale

Items	Instrument Item
Cosmetics sales	Section IV, 1
Pharmacy sales	Section IV, 2
Total front store sales	Section IV, 3
Cosmetic transactions	Section III, Part A, 5
Total front store transactions	Section III, Part A, 6

Figure 9 Retail Output Measures



Contribution to Income

The measures of contribution to income used in the past have been based upon margin. The instrument collected subjective measures of margin on the three categories studied. This scale is shown in Table 8

Table 8: Margin Factors Scale

Items	Instrument Item
Cosmetics margin	Section IV, 4
Pharmacy margin	Section IV, 5
Total front store margin	Section IV, 6

Profits

The profits earned by the store are a direct function of sales and margin (margin = profits/sales). That is, sales times margin gives profits. Thus, profit is subsumed by the previous two measures.

Data Sources

The data for this study were drawn from two sources. The first was a primary data collection effort through questionnaires administered to shop level managers of franchised stores across Canada and to independent chemists in New Zealand. The second source for these data was from the head office of each of the chain stores - there was no equivalent source for the New Zealand data. There is some overlap in this data collection,

and comparisons of the overlapped data (as a validity check on the subjective data) are reported later.

The type of data required, which included identifying the stores so that this was not an anonymous survey, resulted in several interesting problems in questionnaire design. Foremost was assuring completion and return of the questionnaire. The questionnaire mailing was completed in January 1994 in Canada and September 1994 in New Zealand to coincide with the retail outlets' lowest sales month. This was done so that there would be more chance the respondent (the store owner/manager) would have the time and interest to complete and return the survey.

To avoid concerns surrounding the lack of anonymity two stratagems were used. The first was to eliminate questions about the manager him or herself. This increased the comfort level of the manager in replying. The second was to gain the co-operation of the head office of each chain and the New Zealand pharmacy association in order to provide some legitimacy to the research itself.

The physical questionnaire was presented in a booklet form of 8 1/2" by 7". The typesetting was done on a professional quality page layout package and the final version laser printed and professionally copied to lend credibility to the instrument itself. The mailout was accompanied by a covering letter from a manager of the participating firm or association and another letter from the researcher. In addition, an incentive of $2.00 was included in each survey mailed out in Canada - no incentive was offered in New Zealand as they do not have a two dollar note.

Since the initial mailing resulted in a high response rate (72 of 101 useable with four blank returns from one chain, 74 of 111 useable with six blank returns from the second chain, and 564 of 1060 useable with no blanks from the New Zealand Chemists see table9) no follow up survey was sent. The three data sets are kept separate throughout the analysis.

Table 9: Response Rate

Data Source	# Stores	# Responses	# Useable	% Response
Chain A	101	76	72	75.2%
Chain B	111	79	74	71.2%
NZ Chemists	1060	564	564	53.2%
Totals	1272	719	710	56.5%

Chapter IV

Data and Results

Instrument Development

The final survey instrument (as used in New Zealand) is shown in Appendix I (the other two are not shown since they contain information which would compromise the anonymity of the two Canadian chains). The data, as indicated earlier, are the result of questionnaires sent to two different retail chains in Canada and independent chemists in New Zealand. The questionnaire wording varied slightly due to the fact that the culture across the chains and across countries varied (terminology varied between chains - e.g., checkouts versus tills and the order of some of the questions varied). The development of the instrument is discussed in this section as it progresses through its three incarnations. The three forms it takes are: pre-test (chain 1, Canada), re-test (chain 2, Canada), and implementation (New Zealand chemists). The initial plan had been to pre-test on a section of stores from chain 1 (those in a particular management district), then implement the study on the remaining stores from chain 1. When the head office of chain 1 declined further involvement, other avenues for data collection had to be found. This was the initial reason for the introduction of chain 2 into the data set. When the data for chains 1 and 2 were compared, it was found that they were statistically different and thus should not be pooled into a single data set. This meant that the testing of Hypothesis 5 became impossible. To overcome this problem, the third implementation of the questionnaire was developed in New Zealand - the New Zealand chemists. This final implementation provides enough data to fully test Hypothesis 5.

In developing the questionnaire, the following steps were followed: first, the scales were extracted from other sources where possible or developed where there were no pre-existing scales. These scales were then examined by the co-operating manager for chain 1. Some changes, to agree with corporate terminology, were implemented at this stage.

The second step was to administer the questionnaire to the stores under the direct management of this particular corporate manager as a pre-test. As mentioned earlier, in addition to the questionnaire data, MIS data were collected from this chain as well. These data allowed the validity testing of those scales specifically developed for this questionnaire - sales, margin, size, level of inventory, etc..

The third step was to conduct a factor analysis of all the scales together to determine whether there was convergent and discriminant validity in the scale items. The factor analysis was examined to determine how well the scales satisfied the convergent and discriminant validity requirements. The specially developed scales that appeared to be coming together as expected were then compared to the MIS data to assess nomological validity. Those that were not coming together as expected, were modified in an attempt to improve validity and reliability.

The fourth step was to have the modified survey assessed by a manager in the second Canadian chain. Once again, some terminology was changed to suit corporate conditions.

The fifth step was to implement the new instrument to all the stores in the entire Canadian chain of this operation. The results of which were then subjected to the same analysis as the pre-test. When the pre-test and the results from chain 2 were found to be

significantly different, a third implementation of the study was planned and executed in New Zealand.

The sixth step was to modify the instrument according to the information gathered from both the pre-test and chain 2 responses and administer this, modified survey to all New Zealand chemists. The mailing list was purchased from the New Zealand pharmaceutical association. Membership in the New Zealand pharmaceutical association is a requirement of practice, thus all practising chemists were covered in the mailing. This sixth step resulted in the 564 responses reported earlier and provides the data necessary to test Hypothesis 5.

Response Bias Assessment

The high total response rate in Canada reflects the $2.00 incentive, the professional manner in which the survey was presented, the level of commitment brought to the research by the head offices of each chain and the positive effect that had on the respondents. In New Zealand, the response rate was somewhat lower. This is assumed to be the result of not having an incentive and the motivation for the study was coming from an association as opposed to a head office. Table 9 (page 72) shows the response rates for the three questionnaires.

With this level of response, there is little opportunity for non-response bias, but to verify this, data collected from the head offices of the two Canadian chains were used to assess sample bias. "Bias" was assessed by comparing the "hard data" (collected from the head offices' MIS) with the "soft data" (collected through the instruments). Data collected from head office were on size of the operation (in square feet), number of transactions (in

units) and sales (in dollars from one chain and in a standardised distribution from the other). Correlations between the two sources show that the survey instrument data are "unbiased" (see Appendix II). For example, the correlation between the head office figures for total sales and the scale created to represent sales was 0.86 while the correlation between reported store size and actual store size was 0.92 and the correlation between the scale for inventory value and actual average inventory value was 0.70. Histograms of the data for each of size and sales for non-responding stores were also created to search for any pattern in the missing stores. None could be found. Finally, a regression of the reported store size on actual store size was run. The regression coefficient was 0.93. The constant was not significantly different from zero. This exemplifies the data throughout the instrument.

Data Conditioning and Variable Creation

While there was no detectable response bias, there were still some manipulations of the data required before analysis could begin. These manipulations included the recreation of the sales data from chain 2 (from whom data were only available in standardised form), creation of the final scales used, and creation of the productivity measures.

Chain 2 provided information on sales in a standardised form. That is, the sales distribution had been normalised to mean zero, standard deviation one. In addition to this information, they had also provided the average transaction size and the number of transactions for each of their stores. The combination of these data allowed the reconstruction of the sales figures for each store. The process was to calculate the total

number of transactions (sum transactions for each store over all stores), multiply this figure by the average transaction size to get total sales. Total sales divided by number of stores gives average store sales. This was then the mean of the unstandardised distribution. Having the mean and the sum, it was then possible to use a trial and error method to establish the standard deviation of the original series by trying different standard deviations until the sum of the recreated sales figures added to the sum of the calculated sales figures.

The final scales used were determined by examining the purpose of the scale, the way in which the scale was related to external data (where available) and the results of the factor analyses run on all scale elements together. That is, as mentioned earlier, all scale elements from all scales in the instrument were factor analysed simultaneously to examine the discriminant validity of the scales. Some scales appeared to have good discriminant validity in that their elements were clearly and distinctly separated from other scales as distinct factors. Discriminant validity is the situation in which a scale which purports to measure construct A is related only to construct A and not also related to constructs B and C. Discriminant validity is indicated through a factor analysis result in which theoretically unrelated scale items do not load on the same factors. Instead, these factors should represent distinct, clear constructs represented by groups of related scale items.

Not all the scales were so clear in terms of their discriminant validity. Scales that were not clear were reworked in subsequent versions of the instrument to improve discriminant validity. The factor analyses are shown in Appendix III. Note that 0.3000 was taken as the cutoff point to display loadings in the factor analysis. This was merely a pragmatic step to make visual interpretation of the results easier.

As indicated in the earlier section, the scales were tested and refined, then tested again. The first step, on chain 1, saw the initial set of scales factor analysed and rotated using varimax rotation. The factor analysis is unreliable since there were, in fact, almost as many variables being factored as observations. This does not meet the ideal of having at least five observations per variable being factored. Despite this, it was assumed that the rough groupings should give at least an indication of how the scales broke out. Note that the question IIA05 "What is the approximate hourly value of benefits paid to your employees?" was dropped from the factor analysis since there were approximately 50% missing values and those values that were present clearly showed misinterpretation of the question. Misinterpretation showed up through the fact that many of the responses were in terms of percentages or in figures that could clearly not be wage levels (values of less than a dollar).

The results of the factor analysis provided 16 factors which were rotated. Rotation took 68 iterations to converge, once again indicating the weak nature of the analysis. Most factors were fairly clear. A notable exception is the first factor which is an agglomeration of anything that has to do with throughput of the store. It contains variables measuring sales (IV01 - cosmetics sales, IV03 - total front store (tfs) sales), number of employees (IIA01 - total employees, IIA04A - full time employees, IIA04B - part time employees), value of facilities (IIIA01), the number of SKUs (IIIA03 - SKUs in cosmetics, IIIA04 - SKUs in tfs), the number of transactions (IIIA05 - cosmetics transactions, IIIA06 - tfs transactions), and value of inventory (IIIA07 - dollar value of inventory in tfs, IIIA08 - dollar value of inventory in cosmetics). This concentration of loadings is not surprising given the way in which these factors necessarily relate to one another. For example, it is logical that a retailer would build

a larger store in areas where there is higher traffic, thus the size and sales factors are related. The remaining factors tend to be less muddled.

Factor two contains half of the customer comment scale of section I part G (how often do customers comment on the availability of: IG04 - advertised items, IG05 - environmentally friendly items, IG06 - sale priced items) and a measure of the dollars invested in the location (IIIA02). This last item is nearly as much associated with factor one though and it is assumed that it belongs there with the other value and size items, particularly since it is the only negative item in the list.

Factor three is half of the competitive reaction scale ("Please indicate how often your store reacts to the following competitive acts:") with technology (IB04), service (IB05), selection (IB06) and quality (IB07) being included. The first three items of the scale are scattered elsewhere throughout the analysis.

Factor four is the customer similarity scale of Section I Part D ("How similar are your customers in terms of their:") and it survives intact. Factor five is the scale representing how well the respondents feel they are informed of the future of their business climate (Section I Part C - "Please assess your business climate in terms of . . .") and it too survives intact.

Factor six is a combination of two of three parts of the economic growth opportunities scale (Section I Part F, questions two and three - demand for house brands and general consumer demand conditions respectively), two of the remaining three parts of the customer comment scale (Section I Part G, questions one and two - how often do customers comment on: new/extended products and house brands respectively) and the question asking the respondent to report the size of their management team. No explanation is available for the

way this factor is put together and its existence is accredited to the fact that there were too few observations given the number of variables being factor analysed.

Factor seven is one which mainly captures a scale measuring competition (Section I Part A, questions seven, eight and nine - selection, quality and service competition respectively) with a question on labour scarcity also making an appearance. This last question (IA13) was part of a scarcity scale that did not appear to be at all successful in any of the tests run.

Factor eight captures uncertainty. It contains questions one and two of Section I Part A which ask about uncertainty in sales trend and business cycle respectively. The first of these questions is also related to factor five (on predictions) discussed earlier.

Factor nine is mainly margin (Section IV, questions five and six - pharmacy and tfs margin respectively) with pharmacy sales also being included. Given that the scales for margin and sales are so closely related to the actual data (as discussed earlier), this lack of clarity is dismissed as being an artefact of the weak analysis.

Factor ten includes items discussing the store's level of reaction to pricing changes in other stores (Section I Part B, questions one and two - price reductions and sales promotion campaigns respectively), margin on cosmetics (IV04) and a question on labour scarcity (IA12). Since IV04 is also closely related to factor nine (the mainly margin factor) its presence in factor ten is discounted and question IA12 is ignored as that scale (scarcity of resources) did not work at all.

Factors eleven through sixteen are most easily interpreted if their respective elements are associated, not with the factor as identified, but rather with the other factors discussed

earlier. Some of the variables in these factors have strong associations with earlier factors - for example, question IA06 (location competition) is also associated with the earlier factor on competition, IA04 (declining demand) is also associated with factor eight which discusses uncertainty, IIIA02 (total dollar amount invested) is also associated with factor one which includes IIIA01 (total value of facilities), and IA10 (advertising based competition) is also associated with the earlier competition factor (seven).

From this analysis it was clear that some of the scales were working well (customer descriptions, sales, margin, size and investment - when compared to external, verifying data), others were working reasonably, but could be improved (market reaction, competition, customer comments, capital investment) and still others were not working at all (scarcity, wages).

The second version of the questionnaire took these issues into account and the version that was sent to chain 2 was produced. This was not as clean a follow-on as would have been liked as the second chain has a slightly different focus from the first. They are both in the health and beauty aids industry, but chain 1 is more focussed on health with chain 2 more focussed on beauty aids. As a result, the second version of the questionnaire had to be modified to suit the new organisational culture. With both sets of modifications performed (scale improvements and culture allowances) the new questionnaire was administered to the second chain. Even scales which clearly did not work at all in the first test (such as the scarcity scale) were left in to make the instruments as close as possible in terms of the task.

The results of this factor analysis (see Appendix III) show that the instrument has improved substantially, but that it is still not performing as desired. In this instance, there are

more variables than observations once again rendering the results suspect to some degree. Despite that, the factors are clearly better distinguished than they were in the previous version. The first factor is sales (IV01 - IV03) and transactions (IIIA06 - IIIA08) with total and full time labour added in (IIA1 and IIA3A) and the total employees variable also loads quite heavily on factor eleven which is comprised of part time labour only (IIA3B). Thus, it would appear that factor one is a very good indicator of sales. Comparison of the scale with the reconstructed sales figures for chain 2 indicates that there is a 0.6282 correlation between the two, thus verifying the nomological validity of the scale.

Factor two appears to represent size of the operation. It includes the measure of size (itself an excellent indicator of size with a correlation of 0.8160 with the actual size as reported by the chain's MIS), measures of the value of investment in the location (IIIA01, IIIA02 - value of facilities and total dollar amount invested respectively), measures of the number of SKUs (IIIA03 - IIIA05), and measures of amount invested in inventory (IIIA09 - IIIA11). It is clear that there are two scales here, one of physical size and one of capital investment. That the factor analysis could not extract the difference between the two is not overly surprising given the nature of these two constructs and how closely related they are. Obviously, larger stores have larger inventories and cost more to build and maintain.

Factor three is clearly a measure of the stability of the business climate in which the operator finds him or herself. Note how previous scales were combined into one set of statements and phrasing was homogenised - this appears to have corrected earlier problems with these scales. The presence of the two extraneous items (IG07 - sale priced items - and IIIA03 - SKUs in colourings) is dismissed as an artefact of the analysis.

Factor four is a repeat of factor four in the previous study, but without the extra baggage. It is measuring the level of competitive response by the operator to competitive actions on technology, service and selection.

Factor five represents the level of competition the store faces, with competition ranging from location, through selection, quality and service (IC08-IC11). This is a clarification of the earlier scale on competition, but competition based on price and advertising are still not included. This, it was later discovered, is likely because this particular chain seldom advertises and even less seldom has sales. See factor eight below.

Factor six is less clear. It contains a combination of two of the economic attractiveness indicators (IF02, IF03 - brand recognition and general demand respectively) and two of the customer comment indicators (IG01, IG06 - comment on new products and environmentally responsible products respectively). This is difficult to interpret unless it is to suggest that the demand conditions spur commentary on two of the things this chain is known for - bringing out new and environmentally friendly products.

Factor seven is clearly a consumer demographics scale (ID01 - ID03) and is slightly cleaner than the previous version. The inclusion of question IIA6 (how many people are on your management team) is not seen as a problem as that variable is also closely related to factor eleven - part time labour.

Factor eight apparently represents all the things which are not a problem for this chain. They do not cut prices or advertise (thus the inclusion of IC07 and IC12), part and parcel with that is the fact that they do not engage in speculative buying (IC06) as that is usually

associated with sales. Finally, it would appear that capital is not a problem, thus the inclusion of IC15.

Factor nine is the remains the scarcity scale. Included only to retain a link with the previous form of the instrument it is of no interest.

Factor ten is most of the rest of the customer comment scale (IG02 - IG04, all product based comments). The inclusion of IB01 (reactions to price changes) can be discounted as it is also loading on factor four with several other competitive reaction measures.

Factor eleven is part time labour. Other measures which load onto this factor are total employees (IIA1 from factor one), and number of people on the management team (IIA6), indicating that this is a measure of labour effort in the operation.

Factor twelve is clearly margin containing all three margin indicators and nothing else.

Factor thirteen is another case of what does not concern this chain as it is this chain's reaction to other stores' changes in promotion and advertising. Two things this chain does not do.

Factor fourteen is a measure of total labour incentive with wages and number of hours open per week being included. Also loading on factor fourteen is the number of people on the management team (IIA6 - also part of factor eleven).

Factor fifteen contains items in which there is again very little variance for this chain as it is asking about advertised items and the number of tills in the store. This chain almost always has only one or two tills in each store with very rare exceptions so this factor can be ignored.

Factor sixteen, for an unexplained reason, is the first item in the economic conditions scale which asks the respondent to indicate the economic growth potential in their area. This does not load onto the factor which contains the other economic questions (factor six) or anything else for that matter. This would appear to be strictly an anomalous item.

From this analysis, it is clear that the instrument has improved substantially since the first incarnation. The scales are pulling together better and, except for chain specific peculiarities, are internally consistent as demonstrated by the factor analysis.

At this point it is possible to use the data from chain 2 to test hypotheses one to four. There are still not enough data to test hypothesis five. To that end, the data were examined for similarities to see if the two sets could be unconditionally pooled. This is investigated in the next section. Following that, an analysis of the New Zealand data is conducted along the same lines as that followed above.

Data Pooling Tests

While the data clearly show no response bias within each firm, it was also necessary to determine whether the two Canadian data sets could be pooled unconditionally into one set. In order to test for the similarity of data, the productivity measures were each examined for significant differences between firms. For cases where the productivity measure was based upon capital (whether sales or margin productivity), there were no significant differences (as tested with a MANOVA model - see Appendix III). On the other hand, productivity measures based upon labour and space were significantly different across firms. Thus we are left with the decision to pool or not to pool.

Pooling these data would allow greater power in the tests due to larger sample size but would introduce a model mis-specification error based upon the omission of the variable "Firm." The final decision was to pool the two datasets but include the variable FIRM as a class variable in all regression analyses. This works well for the ANOVA and MANOVA approach, but does not solve the problem for LISREL. If there were enough data points, LISREL could be conducted using group analysis, but there are insufficient points in either of the two chains' data sets to perform LISREL analysis. For the LISREL analysis then, the data used are those from New Zealand alone, due to the larger sample and the consistency within the sample. This allows the testing of all hypotheses instead of just the first four.

New Zealand Data

Continuing in the same vein as earlier sections, the scales used in the New Zealand instrument are examined below. Once again, a factor analysis is conducted on all the relevant variables and the results are reported in Appendix III and summarised here.

With the exception of factor one, which is again a combination of two factors representing sales (IV01 - IV03, IIIA05, IIIA06), and investment (IIIA01 - IIIA04, IIIA07, IIIA08), the rest of the factors are remarkably clean. Factor two is clearly uncertainty (IC01 - IC05). Factor three is clearly consumer descriptives (ID01 - ID04). Factor four is clearly labour (IIA1, IIA4A, IIA4B, IIA7). Factor five is clearly reactions to promotion and advertising activity (IB01 - IB03) (as distinct from factor ten which is reaction to more lasting changes (IB04 - IB06)). Factors six and seven are clearly competitive factors separated once more into service based (IC09-IC10) and price based (IC06 - IC08, IC12) components.

Factor eight is clearly another customer descriptor, this time describing how vocal they are (IG01, IG02, IG04 - IG06). Factor nine is clearly margin (IV05, IV06) although the absence of IV04 (cosmetics margin) is a concern. This may be explained by the fact that only very large retail chemists' operations in New Zealand carry cosmetics, as a result this measure may be confounded. Factor ten, as mentioned earlier, is reaction to long term changes. Factor eleven is clearly a measure of economic potential in the area and factor twelve is left being size of operation (if we eliminate IC05 as loading on factor two, and ignore IG03 which is only suggesting that smaller chemists stock out more often).

Thus the measures and scales in this instrument are quite clear and have good discriminant validity. The nomological validity was tested in previous versions and no reason for it not still holding can be raised. The resulting scales are tested for reliability in the next section.

The results of the scale's Cronbach's Alpha are reported below. A second pass is performed later in the more rigorous sphere of SEM in which all scales can be tested for unidimensionality, reliability and independence simultaneously. These results (which support the unidimensionality, independence and reliability results presented below) are discussed in the section describing the LISREL output.

From the output below, we see that the scales all perform quite reasonably. Some initial scales had to be revamped to meet the requirement of unidimensionality, but post hoc analysis supports the changes. For example, the factor analysis showed the scale on competition was not unidimensional, but an examination of the dimensions shows one

dimension representing strictly price and advertising based factors and the other strictly in-store or service factors.

The Cronbach's Alphas range from a low of 0.6390 for the scale representing economic outlook to a high of 0.9106 for the scale representing the capital investment in the operation. The other scales varied between those two points with most scales in the high 0.7 range. Five scales were 0.8 or higher, eight scales were above 0.75, and two scales were less than 0.7. Thus, the scales extracted from the questionnaires exhibit good reliability on the Cronbach's alpha metric. The results of these analyses are shown in Table 10.

Table 10: Cronbach's Alphas for Scales in NZ Chemists' Survey

Scale Components	What it measures	Alpha	n =
IIIA5,6, IV01,2,3	Sales	0.9059	521
IIIA01-4,7,8	Capital Investment	0.9106	518
IC01,02,03,04,05	Uncertainty/Volatility	0.8383	543
ID01,02,03,04	Customer Homogeneity	0.8510	555
IIA1,IIA4A,IIA4B,IIA 7	Labour Effort	0.7814	405
IB01,02,03	Price based reactions	0.8321	556
IC09,10,11	Service based competition	0.7871	548
IC06,07,08,12	Price based competition	0.7198	547
IG01,02,04,05,06	Customer Activity	0.7049	546
IV04,5,6	Margin	0.7589	526
IB04,05,06	Substance based reactions	0.6986	558
IF01,02,03	Economic outlook	0.6390	554

Once the data were assessed and found to be suitable, the hypotheses could be addressed. The first four hypotheses were tested using simple regression and repeated for each data set. That is, the test is conducted on each of chain 1, chain 2 and the New Zealand chemists' data.

Productivity, as defined earlier, is the ratio of an output to an input. There are several different ratios that have been called productivity in retailing and those that will be chosen here are: labour productivity (sales divided by total employees or net margin divided by total employees), space productivity (sales or net margin divided by selling area of the store), and capital productivity (sales or net margin divided by capital invested in the store). These are chosen simply because they appear most frequently in the literature - as noted in the literature review. Each of these is used in turn in the testing of the hypotheses laid out earlier. The result is a set of hypotheses that are tested in several different productivity domains for several different data sets. Note, however, that the definitions of the scales used in each test will be the definition determined from the analysis of the New Zealand data set. This is because that is the only data set where a stringent test of unidimensionality of the constructs could be conducted due to too few observations in the previous two data sets. As was noted earlier, these scales have excellent properties in the New Zealand context and somewhat uncertain properties in the other two contexts. Where the original scales in chain 1 and chain 2 data sets do not map directly to those of the New Zealand data set, the final scale was determined by examining both the New Zealand factor analysis results and the results from that particular chain to increase the likelihood of having a solid scale.

Hypothesis 1

Hypothesis 1a

Hypothesis 1a tests for the presence of positive returns to scale. Returns to scale is the concept which recognises that increasing the size of an operation should increase the amount of profit garnered from the operation. Returns to scale recognises three possible outcomes: extra profit greater than the increased investment (returns to scale greater than one); extra profit equal to increased investment (returns to scale equal to one), and; extra profits less than increased investment (returns to scale less than one). When returns to scale are less than one, they can go below zero as well. It can be that the larger operation is costing more money than it returns to the point where additional investment returns reduced total profit. That is the case when returns to scale is negative. See **Figure 10** for an illustration of this concept.

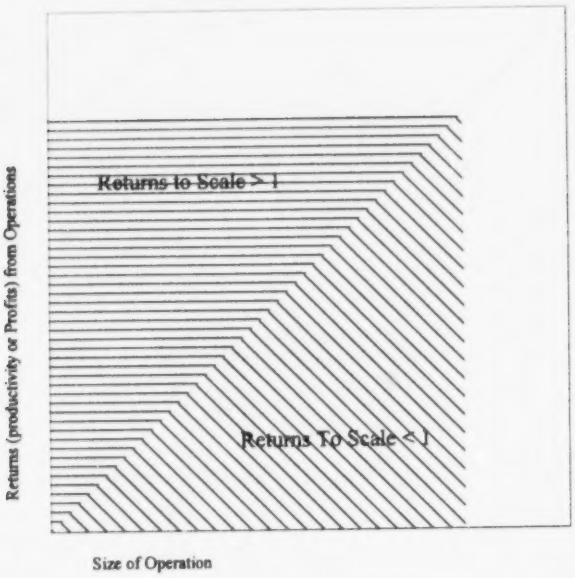


Figure 10 Example of Returns to Scale

Returns to scale can be positive but still have the retailer not wish to increase the size of the operation. If the returns to scale are less than one, one unit of input results in less than one unit of output, then it may be that the retailer wishes to reduce the size of the operation. On the other hand, if they are greater than one, the store size should be increased. Economics would suggest that stores should operate just at the point where the returns to scale pass through the point at which they are one. They should therefore be positive and close to one. Testing for a value of the returns to scale would have to be based upon a "dollar for dollar" scale which is not what this instrument produced. Therefore we are interested only in the sign of the returns to scale.

The rejection of hypothesis 1a would lead to several interesting conclusions. First, it would suggest that some stores are not using their resources efficiently and should change the size of their operation as they are wasting these resources. They are either too large and should downsize or too small and should upsize.

If, on the other hand, hypothesis 1a is supported, then the disposition of hypothesis 1b becomes important. If the returns to scale are both positive and greater than unity then store managers should seek to increase the size of their operation. If this relationship holds throughout the range of store sizes, then there would be no upper limit on the optimal size of the store. Logic suggests that this is not the case and that this conclusion would be the result of a data set in which none of the observations exceeded the minimum cost point on the total cost curve.

Hypothesis 1b

The rejection of hypothesis 1b would indicate that there are points where returns to scale are either increasing, decreasing or both. This would be of great interest to managers as they prefer to operate at the point where returns to scale are at least one. That is, for an increase in inputs of one unit, there is at least one equivalent valued unit of output produced. Stores operating beyond this point would be better off removing some of their investment and placing it in another, smaller store.

A linear relationship (rejecting hypothesis 1b) between size and productivity would again lead to illogical conclusions about the industry. If the returns to scale are less than unity and linear, the investors are better off with more smaller stores to the point that the optimal would be to have infinitely many infinitely small stores. Conversely, if the returns to scale are linear and greater than unity, then each store should be of extreme proportion. Since this cannot logically happen, then the stores in the sample must be operating within a limited range of feasible sizes.

Hypotheses 1a and 1b were tested using regression. Productivity was regressed on the size of the store for each of the three data sets. There are six productivity measures (outlined earlier as sales or net margin divided by labour, space and capital respectively) of which two are inappropriate in this circumstance (those which include space since size and space are identical and using this measure would place the same variable on both sides of the equation leading to bias in the results).

The results for Hypotheses 1a and 1b are mixed. There are both positive and negative returns shown for both size and size squared. Note that space and space squared were

orthogonalised prior to running the regression in order to prevent problems with multicollinearity. That is, space (variable IIIB02) was normalised, then squared. The resulting variable was then normalised as well, giving two variables which are roughly orthogonal and one is the square of the other. For productivity based upon sales, sales productivity of labour and sales productivity of capital (sales productivity of space was omitted since that test would have had space on both sides of the equation which biases the results), the results from the New Zealand survey show that space itself is not significant at all (p values exceed 0.3), and space squared is significant only for sales productivity of labour. In this case, the coefficient is negative and the p value is very small indeed ($p < 0.0001$).

For margin based productivity measures (margin productivity of labour and margin productivity of capital) the results were similarly mixed with an added twist. For margin productivity of labour, space was not significant ($p = 0.3280$), but space squared was significant ($p = 0.0020$) and negative. Margin productivity of capital was exactly the opposite in terms of significance with space being significant and negative ($p < 0.0000$) and space squared not significant at all ($p = 0.9505$). The data from the two Canadian chains were similarly muddled. A summary of the results are shown in the tables below (See Tables 11 through 13) while complete results are in Appendix IV.

It is interesting to note that in the case of the data from chain 1, where there are "hard data" available from the MIS of the head office that the results for those kinds of productivity which can be calculated from the data provided (sales productivity of total wages paid and margin productivity of total wages paid - note the difference between this productivity and that used in the instrument generated analyses) are similar to those from the instruments -

indecisive and inconclusive. For sales productivity of wages, the F Value for the regression was 3.6413 ($p = 0.02$), and the coefficients were negative and positive respectively for space and space squared with space significant ($p = 0.02$) and space squared not significant ($p = 0.2914$). Margin productivity of wages had an F Value of 17.20 ($p < 0.0000$) and again negative and positive coefficients for space and space squared respectively. However, in this case both space and space squared are significant ($p < 0.001$ in both cases).

Table 11: Results for Hypothesis 1a and 1b New Zealand Data					
Productivity Measure	F Value of Regression	Coefficient for SPACE	p value for space	Coefficient for $SPACE^2$	p value for $space^2$
Sales/Labour	9.652*	0.0267	0.4566	-0.2864	0.0000
Sales/Capital	0.8926	-0.0112	0.3829	-0.0130	0.6171
Margin/Labour	8.961*	-0.0449	0.3280	-0.2719	0.0020
Margin/Capital	12.477*	-0.0996	0.0000	0.0027	0.9505

* = significant at $p < 0.001$

Table 12: Results for Hypothesis 1a and 1b Chain 1 Data					
Productivity Measure	F Value of Regression	Coefficient for SPACE	p value for space	Coefficient for $SPACE^2$	p Value for $SPACE^2$
Sales/Labour	2.1130	-0.0177	0.0652	0.0276	0.4978
Sales/Capital	0.9124	-0.0060	0.8996	0.0792	0.6948
Margin/Labour	6.5257**	-0.0528	0.0006	0.0019	0.9757
Margin/Capital	3.1470*	-0.1022	0.0149	-0.0174	0.9200

* = significant at $p < 0.05$ ** = significant at $p < 0.01$

Table 13: Results for Hypothesis 1a and 1b Chain 2 Data					
Productivity Measure	F Value of Regression	Coeffic ient for SPACE	p value for space	Coefficient for $SPACE^2$	p Value for $SPACE^2$
Sales/Labour	0.0436	-0.0112	0.7801	0.0060	0.8821
Sales/Capital	1.7853	-0.0620	0.0723	0.0328	0.3401
Margin/Labour	0.3751	-0.0350	0.4317	-0.0080	0.8590
Margin/Capital	6.8013*	-0.0923	0.0006	0.0394	0.1269

* = significant at $p < 0.01$

The outcome of the analysis is that the status of the relationship between space and productivity is still not known. In pursuing this matter further, analysis of the sales data from the MIS of chain 1 against size shows a clear case of positive but decreasing returns to scale with positive sign for space and a negative sign for space squared. This is as anticipated. Since the nomological validity of the data are not in question and all analyses produce equally unclear results, the best that can be suggested is that these data are incapable of specifying a relationship between selling space in an operation and productivity.

Hypothesis 2

Hypothesis 2 is an examination of the rationale behind infusing a store with additional capital. Accepting hypothesis 2 would indicate that there is a net positive result from the investment of capital and that further investment in the store in specific areas has the potential to provide a positive return on investment. Further investment could be in the form of increasing inventory levels or increasing the level of technology in the store.

Rejecting hypothesis 2 would indicate that stores with less investment are doing as well as those with more at stake. This would suggest that the investor would be better off reducing the investment in the store and using his or her money elsewhere (in another, less capital intensive store for example).

Once again, hypothesis two is tested using simple regression. Each data set was tested separately. The SPSS results for hypothesis 2 are shown in Appendix IV. The results (as seen in tables 14 through 16) are quite startling in that there is clear and almost unanimous support for the null of no relationship or a negative relationship between capital and productivity. Moreover, the results are clearly indicating that the more the capital investment in an operation increases, the lower the productivity goes. Such a result demands further investigation.

In addition to the regressions of productivities derived from the instrument on capital (also derived from the instrument) the productivities from the MIS data from firm one were regressed on capital (only available from the instrument). The results here were equally clear and in almost the opposite direction. Sales based productivities showed positive returns for additional capital while margin based productivities showed no returns or slightly negative returns for additional capital. What appears to be happening is that the measures of sales, margin, space and labour in the instrument are in quite different units. Sales and margin are measured on a seven point scale (lowest value one highest value seven) while labour is measured as the average of the actual numbers of employees total, full time employees, part time employees and number of people on the management team. As a result, the direction of

the relationship between capital and productivity is skewed negatively (due to the apparently stronger relationship between capital and labour or capital and space).

Table 14: Results for Hypothesis 2 New Zealand Data			
Productivity Measure	F Value of Regression	Coefficient for capital	p value for capital
Sales/Labour	2.7976	-0.0401	0.0952
Sales/Space	7.0590*	0.1929	0.0082
Margin/Labour	56.6871*	-0.2170	0.0000
Margin/Space	0.9216	0.0072	0.3376

* = significant at $p < 0.01$

Table 15: Results for Hypothesis 2 Chain 1 Data			
Productivity Measure	F Value of Regression	Coefficient for capital	p value for capital
Sales/Labour	9.1998**	-0.0320	0.0035
Sales/Space	0.2168	-1.6E-5	0.6431
Margin/Labour	24.4672**	-0.1198	0.0000
Margin/Space	13.0784**	-1.9E-4	0.0006

* = significant at $p < 0.05$ ** = significant at $p < 0.01$

Table 16: Results for Hypothesis 2 Chain 2 Data			
Productivity Measure	F Value of Regression	Coefficient for capital	p value for capital
Sales/Labour	0..5883	-0.0454	0.4461
Sales/Space	1.0894	-3.5E-4	0.3010
Margin/Labour	5.7145*	-0.1526	0.0200
Margin/Space	10.9996*	-9.1E-4	0.0016

* = significant at $p < 0.01$

Hypothesis 3

Accepting hypothesis 3 would be an indication that markets are not efficient. That is, if higher competition can reduce a firm's productivity, then the consumer is not benefitting from the added competition. A decrease in productivity with an increase in competition *ceteris paribus* would mean that the store had not adjusted its resource levels to the lower demand. Such behaviour should result in failure.

Rejecting hypothesis 3 would indicate that a store in intense competition is either managing with fewer resources or has managed not to lose customers to the competition. In either case, those stores in highly competitive locales could serve as models for other stores in trimming resource usage for a given level of output or in ensuring that customers do not migrate to other stores.

Interestingly, there is a clear dichotomy in results between the Canadian data and the New Zealand data. The Canadian data (from chains one and two) show only one significant relationship out of 24 possible regressions. This is what one would expect if there were no

relationship at all - given that the accepted error level for type one error is 0.05 (one in twenty) it is not surprising that one regression was significant. Thus, all the Canadian relationships are assumed non-significant.

In direct contrast are the New Zealand data which are showing a clear negative relationship between level of competition and productivity. That is, the higher the competition, the lower the productivity. This relationship is significant in half of the regressions studied. Results are summarised below and full results are presented in Appendix IV.

Table 17: Results for Hypothesis 3 New Zealand Data			
Productivity Measure	F Value of Regression	Coefficient for service based competition	p value for service based competition
Sales/Labour	0.6916	-0.0060	.7927
Sales/Space	5.604*	-.0161	0.0183
Sales/Capital	0.6104	0.0064	0.4350
Margin/Labour	3.8672*	-0.0571	0.0500
Margin/Space	8.2757*	-0.0197	0.0042
Margin/Capital	7.6825*	-0.0404	0.0058

* = significant at $p < 0.05$

Table 18: Results for Hypothesis 3 New Zealand Data			
Productivity Measure	F Value of Regression	Coefficient for price based competition	p value for price based competition
Sales/Labour	2.3771	.0405	.1240
Sales/Space	2.7932	-.0133	.0953
Sales/Capital	1.1457	-0.0102	.2850
Margin/Labour	1.1908	-.0368	.2759
Margin/Space	4.0853*	-.0162	.0438
Margin/Capital	12.4942*	-0.0599	.0004

* = significant at $p < 0.05$

Table 19: Results for Hypothesis 3 Chain 1 Data			
Productivity Measure	F Value of Regression	Coefficient for service based competition	p value for service based competition
Sales/Labour	0.5796	0.0067	.4492
Sales/Space	1.9216	3.7E-5	.1705
Sales/Capital	0.0795	.0079	.7789
Margin/Labour	.0374	-.0043	.8472
Margin/Space	.0471	1.0E-5	.8288
Margin/Capital	.1635	-.0210	.6873

* = significant at $p < 0.01$

Table 20: Results for Hypothesis 3 Chain 1 Data			
Productivity Measure	F Value of Regression	Coefficient for price based competition	p value for price based competition
Sales/Labour	.7365	-0.0104	.3940
Sales/Space	.6589	-3.0E-5	.4199
Sales/Capital	2.1581	-0.0555	.1467
Margin/Labour	1.6234	-0.0388	.2072
Margin/Space	1.3118	-7.2E-5	.2563
Margin/Capital	2.2354	-.1050	.1398

* = significant at $p < 0.01$

Table 21: Results for Hypothesis 3 Chain 2 Data			
Productivity Measure	F Value of Regression	Coefficient for service based competition	p value for service based competition
Sales/Labour	.2335	.0121	.6307
Sales/Space	.1097	4.7E-5	.7417
Sales/Capital	1.6262	.0264	.2073
Margin/Labour	.3244	0.0152	.5711
Margin/Space	.7164	1.0E-4	.4008
Margin/Capital	3.8200	.0324	.0555

* = significant at $p < 0.05$

Table 22: Results for Hypothesis 3 Chain 2 Data			
Productivity Measure	F Value of Regression	Coefficient for service based competition	p value for service based competition
Sales/Labour	1.4890	-.0395	.2274
Sales/Space	2.7672	3.1E-4	.1019
Sales/Capital	.2351	-.0141	.6297
Margin/Labour	.0065	-.0030	.9359
Margin/Space	4.5161*	3.5E-4	.0381
Margin/Capital	.0179	.0031	.8940

* = significant at $p < 0.05$

Hypothesis 4

An acceptance of hypothesis 4 would suggest that paying a store's employees higher salaries may in fact benefit the store. If the store's productivity were to increase with wages, then further investigation may be called for. This further investigation would examine the shape of the relationship and the productivity return for a given wage investment.

Rejecting hypothesis 4 would indicate that there is no incentive to the store manager to increase wages. Any increase in wages will come strictly from the profits of the store as there would be no corresponding increase in store output to offset the increase in resource usage.

The results of this hypothesis test are mixed, but they tend in the direction of rejecting the null of no effect of wages on productivity. The tests again are conducted on each data set separately. The New Zealand data are slightly different from the other two data sets in

that the question on wages asked for the weekly total wage bill. Thus this measure is directly related to labour - the more employees, the higher the wage bill. Therefore, sales and margin productivity of labour versus wages could not be assessed in the New Zealand data. Instead, the remaining productivity measures were assessed against wages.

As can be seen from the results below, three of the four relationships are strongly positive. The fourth one (margin productivity of capital) is anomalous as it is strongly negative. There is no ready explanation for this at this time. This may require further investigation, but for now is attributed to unknown factors.

With the exception of the aforementioned anomaly, the coefficients of all analyses are positive. While there are only four that are significantly positive, the fact that the remaining, insignificant relationships, are also positive provides moral support for the notion that the higher the wages the higher the productivity if nothing else.

Table 23: Results for Hypothesis 4 New Zealand Data

Productivity Measure	F Value of Regression	Coefficient for wages	p value for wages
Sales/Capital	4.1272*	1.4E-5	.0428
Sales/Space	49.6192**	1.3E-5	.0000
Margin/Capital	8.2386**	-3.5E-5	.0043
Margin/Space	14.6229**	8.9E-6	.0002

* = significant at $p < 0.05$ ** = significant at $p < 0.01$

Table 24: Results for Hypothesis 4 Chain 1 Data			
Productivity Measure	F Value of Regression	Coefficient for wages	p value for wages
Sales/Labour	.3784	.0079	.5405
Sales/Space	3.5954	7.3E-5	.0623
Sales/Capital	4.320*	.0832	.0416
Margin/Labour	.2059	.0147	.6515
Margin/Space	1.360	7.8E-5	.2478
Margin/Capital	1.5969	.0957	.2108

* = significant at $p < 0.05$

Table 25: Results for Hypothesis 4 Chain 2 Data			
Productivity Measure	F Value of Regression	Coefficient for wages	p value for wages
Sales/Labour	.0326	.0016	.8572
Sales/Space	2.3328	7.3E-5	.1320
Sales/Capital	.3192	.0065	.5742
Margin/Labour	.0496	.0021	.8245
Margin/Space	3.232	7.5E-5	.0772
Margin/Capital	.3117	.0048	.5788

* = significant at $p < 0.05$

Hypothesis 5

Hypothesis 5 is an examination of the manner in which the terms in the model of productivity interrelate. An acceptance of this hypothesis would indicate that there is a

construct that can be termed total factor productivity which in turn drives the output of the store through the sales and contribution aspects and finally the profits.

Rejection of hypothesis 5 would be a rejection of the much of the work that has gone before. Such a rejection must be considered carefully as it must stand the closest scrutiny. If hypothesis 5 is rejected, and the rejection cannot be explained by methodological or sampling issues, then the area of productivity analysis in retailing needs to be re-examined from a fundamental, theoretically based point of view. It is not expected that this will be the outcome.

In order to investigate this hypothesis, the model has to be created and tested in LISREL (Joreskog and Sorebom 1989). This implies that, first the measurement model must be created and tested and then the entire model. In keeping with the approach as suggested by Anderson and Gerbing (1988), the model of Figure 9 was created in LISREL version 8.

Investigating the second data set using LISREL required some adjustments as well. First, the model required some correlated error terms be added before a reasonable fit could be achieved. The meaning of correlated error terms has been explored by Gerbing and Anderson (1984). The implications of a correlated measurement error is that there is another factor that could be used to explain the structure of the model. That is, either the factor should be broken out into more first order factors, or a second order factor needs to be included. In this case, it is clear that the correlated measurement errors are due to the fact that there are patterns in the information that are not being captured by the designed constructs. That is, the correlated errors show a link between pairs of measures that are for cosmetics and pharmacy sales and margin respectively, measures of labour in the construct

size and dollar investment in permanent assets in the store. These correlated errors could be removed through the inclusion of additional latent constructs, but this would make the model less easy to interpret.

Another adjustment required was the removal of the error variance estimate for IV06. The estimate for the error variance of Average Gross Profit on Retail Sales (IV06) was insignificant and estimating it lead to a negative error variance for IV06. Thus it was dropped in the measurement model stage.

Finally, when the second order factor "Productivity" (called Producty) was added, the estimate for the path from Capital to IIIA08 (Dollar Value Typically on Hand in Cosmetics) was not identified. This path was then fixed at the value found in the measurement model (0.69) which is the same value found in the direct model. In addition, the error variance for latent construct Capital was not identified, as a result, it was fixed at the value found in the direct model (0.19).

When these adjustments were made, the model was estimated and the fit examined. This lead to the support of hypothesis 5. The model improves in fit with inclusion of a second order factor (as indicated by Chi Square with 1 degree of freedom measure). This factor has been called productivity and represents the unmeasured ability of the manager to convert raw resources (space and capital) into outputs (sales and margin on sales).

The models created from this data set are shown in Figures 8 through 15. The full goodness of fit results and the output files are shown in Appendix V. Highlights of the goodness of fit results are shown below in Table 26.

Table 26: Highlights of LISREL Results			
Statistic	Measurement Model	Direct Model	Productivity Model
Chi Square/d.f. (p value)	326.84/80 (0.0)	341.09/82 (0.0)	342.26/84 (0.0)
Goodness of Fit	0.89	0.89	0.89
Chi Square Difference with 1 Degree of Freedom	5.49 (0.019)	2.97 (0.085)	2.94 (0.086)

Conclusions

This thesis fully examined the concepts and constructs of retail productivity in a way that has not previously been done. The benefits behind this study are that the state of the art in retail productivity analysis has been updated with new data and new techniques to remain in the forefront of marketing accomplishment. This thesis addressed both of these issues directly and added substantially and substantively to the knowledge in the area.

The results of the five hypotheses are generally as expected with the exception of hypotheses one and three. The tests of hypothesis one were unable to extract any real information from the data set as it stands. This leaves the question of returns to scale in productivity open for further investigation and interpretation. The remaining hypotheses resulted in generally expected results confirming some previous work and setting the record straight on some other points.

The capital investment result makes good economic sense. It would be illogical to suggest that managers invest more in stores with lower productivity. Such a situation may happen in the short run (turnaround situation) but is unsustainable in the long run. Having the data bear this out suggests another avenue for managers to control the productivity of their operations. There is research to indicate that one area of potential investment would be in terms of "psychic stock" in order to induce higher purchase rates per customer visit.

The country based nature of the relationship between competition and productivity begs the question of why it occurs. The most plausible answer is that the data from Canada are from two large, well organised, franchised operations which choose their sites with care,

provide intense training and support for their franchisees and are constantly passing along tips on how to improve operations. In contrast, the New Zealand data were drawn from independent operators who must rely on their own ingenuity and experience to extract the best performance from their market. This might suggest that the New Zealand operators are more sensitive to competition since they do not have the backing of a large organisation behind them.

Another potential explanation for these results is that the market in New Zealand is regulated with a limited number of licenses granted for chemists. Despite this, there are only 3000 people for each operating chemist in the country (the population of New Zealand is approximately 3.3 million and there are 1100 chemists) which means that the competition is quite fierce. With that small a base, any move by the competition can have a dramatic impact on an operator's performance.

The results of the LISREL model stand as a strong indication that the concept of productivity as a measure of the ability of the manager to effectively and efficiently transform inputs into outputs is a sound one. This in turn implies that the theoretical basis for continuing the investigation of productivity in future research makes good sense.

Discussion

Implications For Theory

General

The results of this study clearly show that productivity is a clear and useful concept in addressing retail performance. In particular, this study addressed the inter-relationships among the variables that have been highlighted as being antecedents to retail productivity and performance in the past.

Past studies indicated that there were substantial cross-sector differences within retailing and this study agrees with that statement. This implies that each sector of the retail economy requires a unique approach when researching productivity effects. Some sectors will require a focus in a direction that diverges from that found in previous work. Whether a particular sector requires a divergent approach can only be determined through direct examination of that sector. An example of a divergent approach would be a situation in which space productivity is extremely important in one sector and unimportant in another.

Moreover, the lack of effect of competition in Canada can be taken as a suggestion that this industry is very nearly perfectly competitive with the level of productivity across regions staying consistent despite changes in local competition. If level of competition were to alter productivity, this would imply substantial entry or exit costs to the industry. Such costs would allow a local operator to extract excess economic rents (in the case of lower competition) or to drive productivity down (survive on below par economic rents) without the possibility of adjustment from the marketplace. The lack of relationship between

competition and productivity strongly suggests that this sector, unlike others studied previously, is nearly perfectly competitive.

In this case, the approach to perfect competition is facilitated by the communication through the chain. This communication will allow all members of a chain to take advantage of productivity improvements found at any store in the chain. Thus, it is not necessary to wait until competition forces productivity improvements, rather improvements can be learned through others' experiences.

Note that in New Zealand, where there are substantial entry and exit barriers (government regulation are entry barriers and the lack of alternate employment for pharmacists is an exit barrier), the level of competition does make a difference to the productivity of the sector.

The lack of conclusion with respect to the question of the effect of size on the productivity in this sector is curious. Previous work has generally found that there is some relationship between size and productivity. This was not the case in this study. The reasons for this have not been identified despite the fact that there were clear relationships between size and the components of productivity. It is possible that this is another case where the units of measure are affecting the results adversely.

Specifics

The model that is developed in this research has substantial implications for theory in retailing. The construct of productivity was raised in the early days of marketing research and has been defined along the lines of economic theory - using outputs over inputs in a ratio.

The LISREL model developed in this research addresses productivity in a substantially different light. It approaches the question from the point of view of the process of taking inputs and converting them into outputs for consumers. This model is more comprehensive and uses a more sophisticated testing approach than models previously generated. The model suggests that productivity should be included as a construct in a model which examines this conversion or transformation process of inputs to outputs. This confirms the validity of productivity as an important and useful construct in studying retail performance.

These results imply that productivity is at least as important as practitioners have been suggesting - potentially more so. The implication is that productivity must be examined, monitored and controlled in this retail setting.

Furthermore, this study created a model which was capable of addressing the confluence of several constructs simultaneously through the use of structural equation modelling. While multiple inputs and outputs have been examined in the past, they have not been examined in a statistical sense, only a deterministic sense using data envelopment analysis (e.g., Donthu et al, 1995). As a result, this study adds substantially to the theory by examining the way in which these interrelated constructs come together to influence retail productivity, output and, ultimately, performance.

Implications For Practice

Practitioners - managers and owners of retail operations - should be acutely aware of several of the results of this thesis. First of all, the results of hypotheses two through four are clear. They, jointly, imply that it is essential that practitioners strive to achieve the highest

productivity possible. The differences between the Canadian and the New Zealand data suggest that one of the potential outcomes of striving for better productivity may be less sensitivity to competition.

A second clear conclusion is that wages have an effect on productivity. This suggests that practitioners should examine the rate of return from wages very carefully and may find themselves in a situation in which paying their employees may result in a sufficiently higher productivity gain than the cost of the increased wages.

The third item that practitioners should glean from this study is that investing more in a store results in higher productivity. That is, a store which is newer, more modern, uses better equipment and signage can be expected to produce better than a store which does not. The implication is that capital investment in a store can be a worthy use of funds.

Limitations

The clearest limitation in this study is that the units of measure of some of the indicators may have contributed to the results or lack of results. While this is a potentially dangerous situation, the existence of the "hard data" from chain 1 allowed it to be diffused without causing extreme problems. Clearly, this is an area that requires further scrutiny.

Further limitations stemming from the units problem arise as the actual results are assessed for implementation by practitioners. The regression weights that are provided are not in common (for example dollar per dollar) units, thus the conclusions will require further investigation and interpretation before a retailer can determine whether he or she should increase capital investment, respond to competitive pressures, or pay their employees more.

Ideally, the next step would be to extract the information in a way which is immediately useful to practitioners, that is to create a set of elasticities which can be compared to the operation's current status. Such a comparison would immediately allow the retailer to determine whether s/he should adjust the use of their resources in one direction or another. The current information from this thesis does not allow this.

The Canadian information on wages may be insufficient to detect a wage effect in productivity. A more accurate, or perhaps more pertinent measure may be required. For example, it could be that it is necessary to measure the relative wages rather than the absolute wages. This could be done by comparing the actual wages paid with the average wage in the sector in that region. This approach has not previously been used.

Given that a substantial portion of the data for this research comes from two large, multinational chains operating in Canada, it should not be surprising that the fundamental precepts of microeconomics hold. These chains will operate mainly in markets of sufficient size to support their operating range and, as such, will not go into markets that are too small. In addition, since they are a chain, information on how to improve productivity is passed along communicating the best approaches to all members. This would allow innovations from one chain member to benefit another, irrespective of whether the local conditions should demand it.

In contrast to this situation is that of New Zealand where the respondents were independent operators. The divergence in results cannot be solely accredited to this dichotomy, but it may contribute to it. The inability to specify the source of the divergence is a short coming of this thesis. Ideally the instruments would have been identical in all

situations and not been a progression of improvements in three stages. Since this did not happen, the reasons for the differences in some of the results are confounded.

In more detail, there were unique limitations attached to each hypothesis test. Hypothesis one contradicts almost all earlier research which suggests a problem with the way in which the test was implemented. The potential areas for fault are, again, units of measurement and model mis-specification. While units of measurement seem the most likely source of the problem, some doubt is cast since the absolute units from chain 1's MIS tend to concur with the relative units the instrument provides. This leaves model mis-specification as a source of the difficulty. It could be that there are one or several variables that are operating on the data in a way to wash out the effects of size on productivity. Finding such a variable would certainly improve the quality of this research.

Hypothesis two suffers from the effects of the differing strengths of relationships between the numerators and denominators of the various productivity functions. Being forced to resort to using the "hard data" to assess this hypothesis is a substantial weakness in the instrument and analysis design, one that will have to be corrected for this work to proceed.

Hypothesis three is not as consistent as could be expected. There are consistent patterns within countries, but the inability to create a clear set of results in either direction is obviously a shortcoming. Once again, this is an area that could use improvement before further research is conducted. Ideally, this would dealt with in terms of instrument redesign and the appropriate research could then be conducted in a similar fashion to that already performed.

Future Research

A further, more detailed study should examine productivity in a non-chain environment. One in which the operators arrive at their own conclusions as to how best to run their retail outlet. This would eliminate the potential for the communication mechanisms within a single chain biasing the results. A comparison of such results with the current set would indicate whether the industry is truly a perfectly competitive environment.

Further research should also be carried out on other dimensions of retailing. Not just other sectors, but within sectors across national boundaries using identical sectors and identical instruments. This would allow further reinforcement of the conclusions attained within the study.

Finally, a multi-sector study using a consistent data collection technique across sectors should be conducted to determine the extent of the sector differences within retailing. Until such a study is conducted, it is possible only to determine that there are differences between sectors, not how large they are nor whether the differences will have a substantial impact on the best way to operate a retail outlet.

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Appendices

Appendix I: Survey Instruments
Appendix II: Data Assessments
Appendix III: Scale Factor Analysis Results and Pooling Results
Appendix IV: Regression Results
Appendix V: LISREL Results

Appendix I: Survey Instruments

Insert Questionnaires Here

Please feel free to write any comments you may have about our study in particular or retail productivity in general in the space below.

We are mainly involved in dispensing of Pharmaceuticals which account for about 75% of our turnover

Thank you for your participation. Please place the completed questionnaire in the freepost envelope provided and mail it back to us at:

David Taylor, Department of Marketing and International Management, Faculty of Management Studies, University of Waikato, Private Bag 3105, Hamilton.

If you have any questions or concerns regarding this questionnaire or the study in general, please feel free to call us at (7) 856 2889 ext 4248. Thank you.

TOTAL P.05

Managing Pharmacies in Difficult Times

A Study of Productivity in Independent Chemists' Shops in New Zealand

1994

University of Waikato,
Department of Marketing and
International Management

This questionnaire is designed to elicit information on the situation you, as a manager of a retail pharmacy, face in your operation and the decisions that you make to ensure your success. No proprietary information collected in this survey will be released to anyone at any time. Please take about ten minutes to answer the questions in the survey as completely as you can. If you do not know an answer, please make an educated guess. Thank you in advance for your participation.

Serial

1(

Section I: This first set of questions addresses the environment you face as a manager.

A: Please indicate the degree to which the following items affect your business operations:

		Very Little						Very Great
1	Government policy changes.	1	2	3	4	5	6	7
2	Pharmacy Cooperatives.	1	2	3	4	5	6	7
3	A & E Clinics.	1	2	3	4	5	6	7

B: Please indicate how often your store reacts to the following competitive acts:

		Very Seldom						Very Often
1	Pricing changes.	1	2	3	4	5	6	7
2	Sales promotion campaigns.	1	2	3	4	5	6	7
3	Advertising and publicity campaigns.	1	2	3	4	5	6	7
4	Technological changes.	1	2	3	4	5	6	7
5	Service improvements.	1	2	3	4	5	6	7
6	Changes in merchandise selection.	1	2	3	4	5	6	7

C: Please indicate the degree to which you perceive each of the following to be characteristics of your industry. Circle the number that most closely represents your opinions.

		Very Little						Very Great
1	Uncertainty regarding overall sales trend.	1	2	3	4	5	6	7
2	Uncertainty regarding business cycle.	1	2	3	4	5	6	7
3	Uncertainty regarding demand.	1	2	3	4	5	6	7
4	Uncertainty regarding accuracy of projections.	1	2	3	4	5	6	7
5	Predictability of business climate.	1	2	3	4	5	6	7
6	Competition based on deal buying.	1	2	3	4	5	6	7
7	Competition based on price.	1	2	3	4	5	6	7
8	Competition based on having prime retail location.	1	2	3	4	5	6	7
9	Competition on merchandise selection.	1	2	3	4	5	6	7
10	Competition on merchandise quality.	1	2	3	4	5	6	7
11	Competition on service.	1	2	3	4	5	6	7
12	Competition based upon advertising spending.	1	2	3	4	5	6	7
13	Periods of stock scarcity.	1	2	3	4	5	6	7
14	Periods of labour scarcity.	1	2	3	4	5	6	7
15	Periods of capital scarcity.	1	2	3	4	5	6	7

Serial No. 1067

D: How similar are your customers in terms of their: (please circle one)

		Very Similar						Very Dissimilar
1	Demographic characteristics (income, age, education, social class).	1	2	3	4	5	6	7
2	Lifestyle characteristics.	1	2	3	4	5	6	7
3	Preferred variety of product brands/features.	1	2	3	4	5	6	7
4	Product value preferences.	1	2	3	4	5	6	7

E: Please write your answer in the space provided.

1 How many other chemists are within: 1 km? 0
5 km? 1

2 How often do you "shop" the competition (to check prices and offerings)?
Nil per Day/Week/Month/Year
(please indicate both frequency and span - e.g., 1 per week)

F: Please rate the following statements as they apply to your store. (please circle one)

		Very Low						Very High
1	Economic growth potential in market area.	1	2	3	4	5	6	7
2	Demand for non-pharmacy items.	1	2	3	4	5	6	7
3	General consumer demand conditions.	1	2	3	4	5	6	7

G: How often do customers comment on the availability of: (please circle one)

		Very Seldom						Very Often
1	New/Extended products.	1	2	3	4	5	6	7
2	Local brands.	1	2	3	4	5	6	7
3	Unstocked items.	1	2	3	4	5	6	7
4	Advertised items.	1	2	3	4	5	6	7
5	Environmentally friendly items.	1	2	3	4	5	6	7
6	Sale priced items.	1	2	3	4	5	6	7

Section II: The next set of questions is about the resources you have at your disposal in operating your store.

A: Please write your answer in the space provided next to each question.

1 How many people does your store employ? 3

2 Of the above, how many are involved only in the dispensary? 3

3 Of the total, how many are only involved in cosmetics? 0

4 How many of your employees are: full-time? 2
part-time? 1

5 How many hours a week is your store open? 40

6 What is the approximate value of weekly wages paid to your employees? $700-00

6 What is the approximate value of benefits paid to your employees? 2 %
(percent of wages)

7 How many people are on your management team (include yourself if you work in this store)? 3

8 How many tills does your store have? 1

Section III: This next set of questions asks you how well your store performs in these economic conditions using the inputs you have available to you.

A: For the following questions, please indicate how your business compares with others of similar size and type. Circle the number that best represents your store.

		Much Less Than Other Chemists		The Same As The Average Chemist			Much More Than Other Chemists	
1	Total value of store facilities (fixed assets).	1	2	~~3~~	4	5	6	7
2	Total dollar amount invested in your location.	1	~~2~~	3	4	5	6	7
3	Number of different stock keeping units in cosmetics.	~~1~~	2	3	4	5	6	7
4	Number of different stock keeping units in the retail section.	1	~~2~~	3	~~4~~	5	6	7
5	How many cosmetics transactions take place in an average week.	~~1~~	2	3	4	5	6	7
6	How many total retail transactions take place in an average week.	1	~~2~~	3	4	5	6	7
7	Dollar value of inventory typically on hand in total retail.	1	~~2~~	3	4	5	6	7
8	Dollar value of inventory typically on hand in cosmetics.	~~1~~	2	3	4	5	6	7

B: For the following questions, please write the answer in the space provided.

1 Total area of your store. 75 sq metres

2 Total selling space of your store. 50 sq metres = 100%

- 2a Percent of selling space in cosmetics. 10 %
- 2b Percent of selling space in pharmacy. 60 %
- 2c Percent of selling space in other. 30 %

C: For the following questions, please write your answer in the space provided.

1 What percentage market share (of stores with which you directly compete) does your store achieve? _____ %

2 Has your store opened or undergone any major changes in the past year (circle one)? Yes No
~~no~~ location; ~~no~~ management; ~~no~~ start-up; ~~yes~~ remodelling; ____ other (what? _____)

3 How many hours in an average week do you work in this store? 20 hours

4 How long have you worked in a chemist's shop? 40 years

5 How long have you been in the present position? 35 years

6 What is the title of your position? Proprietor

7 What is your education background (tick all that apply)?

(✓) School Certificate (✓) University Entrance (✓) Diploma in Pharmacy
( ) BPharm ( ) Other Bachelor Degree ( ) MHealthAdmin
( ) Other Grad Degree ( ) Company Seminars ( ) Public Seminars
( ) Other Not Listed (please specify) _____

Section IV: This last set of questions asks you to circle the number that best represents your store's performance.

		Much Less Than Other Chemists		The Same As The Average Chemist			Much More Than Other Chemists	
1	Cosmetics sales.	~~1~~	2	3	4	5	6	7
2	Pharmacy sales.	1	~~2~~	3	~~4~~	5	6	7
3	Total retail sales.	1	~~2~~	3	4	5	6	7
4	Average gross profit on cosmetics sales.	~~1~~	2	3	4	5	6	7
5	Average gross profit on pharmacy sales.	1	2	~~3~~	~~4~~	5	6	7
6	Average gross profit on total retail sales.	1	2	~~3~~	4	5	6	7

Out of necessity (differing terminology), the surveys for Chain 1, Chain 2 and the New Zealand Chemists were slightly different. In addition to terminology differences, The Chain 2 survey was rearranged slightly to allow the inclusion of three "grabber" questions up front. The following table provides a "map" of how the three surveys relate to one another. The New Zealand questionnaire was identical in format to the Chain 2 questionnaire in Canada with the exception of the inclusion of three alternate "grabber" questions and the use of metric measures.

Table 27: Questionnaire Mapping

Chain 1 Item	Chain 1 Wording	Chain 2 Item	Chain 2 Wording	New Zealand Item	New Zealand Wording
IV01	Cosmetic Sales	IV01	Colourings Sales	IV01	Cosmetics Sales
IV02	Pharmacy Sales	IV02	Above the Neck Sales	IV02	Pharmacy Sales
IV03	Total Front Store Sales	IV03	Below the Neck Sales	IV03	Total Front Store Sales
Totsale	Total Dollar Sales for Cosmetics, Pharmacy and TFS	Totsale	Total Dollar Sales for Colourings, Above and Below the Neck		No Equivalent
Customers	Number of Transactions for previous fiscal year	Customers	Number of Transactions for previous fiscal year		No Equivalent
IV04	Average Net Margin on Cosmetic Sales	IV04	Average Net Margin on Colourings Sales	IV04	Average Net Margin on Cosmetic Sales
IV05	Average Net Margin on Pharmacy Sales	IV05	Average Net Margin on Above the Neck Sales	IV05	Average Net Margin on Pharmacy Sales
IV06	Average Net Margin on TFS Sales	IV06	Average Net Margin on Below the Neck Sales	IV06	Average Net Margin on TFS Sales

Chain 1 Item	Chain 1 Wording	Chain 2 Item	Chain 2 Wording	New Zealand Item	New Zealand Wording
IIIA01	Total Value of Store Facilities	IIIA01	Total Value of Store Facilities	IIIA01	Total Value of Store Facilities
IIIA02	Total Dollar Amount Invested in Your Location	IIIA02	Total Dollar Amount Invested in Your Location	IIIA02	Total Dollar Amount Invested in Your Location
IIIA07	Dollar value of inventory typically on hand in TFS	IIIA09	Dollar value of inventory typically on hand in above the neck products	IIIA07	Dollar value of inventory typically on hand in TFS
IIIA08	Dollar value of inventory typically on hand in cosmetics	IIIA10	Dollar value of inventory typically on hand in below neck products	IIIA08	Dollar value of inventory typically on hand in cosmetics
		IIIA11	Dollar value of inventory typically on hand in colourings		

Chain 1 Item	Chain 1 Wording	Chain 2 Item	Chain 2 Wording	New Zealand Item	New Zealand Wording
IA06	Competition based on having prime retail location	IC08	Competition based on having prime retail location	IC08	Competition based on having prime retail location
IA07	Competition on merchandise selection	IC09	Competition on merchandise selection	IC09	Competition on merchandise selection
IA08	Competition on merchandise quality	IC10	Competition on merchandise quality	IC10	Competition on merchandise quality
IA09	Competition on service	IC11	Competition on service	IC11	Competition on service
IIA6	What is the approximate hourly value of benefits paid to your employees	IIA5a	What is the approximate hourly value of wages paid to your employees	IIA6A	What is the approximate value of weekly wages paid to your employees
IIA1	How many people does your store employ	IIA1	How many people does your store employ	IIA1	How many people does your store employ
IIA7	How many people are on your management team	IIA6	How many people are on your management team	IIA7	How many people are on your management team

Chain 1 Item	Chain 1 Wording	Chain 2 Item	Chain 2 Wording	New Zealand Item	New Zealand Wording
IIA8	How many checkouts does your store have	IIA7	How many tills does your store have	IIA8	How many tills does your store have
IIIA03	Number of different stock keeping units in cosmetics	IIIA03	Number of different stock keeping units in colourings	IIIA03	Number of different stock keeping units in cosmetics
IIIA04	Number of different stock keeping units in TFS	IIIA04	Number of different stock keeping units in above the neck products	IIIA04	Number of different stock keeping units in TFS
		IIIA05	Number of different stock keeping units in below the neck products		
IIIA05	How many cosmetic transactions take place in an average week	IIIA06	How many colourings transactions take place in an average week	IIIA05	How many cosmetic transactions take place in an average week
IIIA06	How many front store transactions take place in an average week	IIIA07	How many above the neck transactions take place in an average week	IIIA06	How many front store transactions take place in an average week
		IIIA0 8	How many below the neck transactions take place in an average week		

Chain 1 Item	Chain 1 Wording	Chain 2 Item	Chain 2 Wording	New Zealand Item	New Zealand Wording
IIIB02	Total size of the selling space of the store in square feet	IIIB2	Total size of the selling space of the store in square feet	IIIB02	Total size of the selling space of the store in square feet
IIA01	How many people does your store employ	IIA01	How many people does your store employ	IIA01	How many people does your store employ
IIA04a	How many of your employees are full time	IIA03a	How many of your employees are full time	IIA04a	How many of your employees are full time
IIA04b	How many of your employees are part time	IIA03b	How many of your employees are part time	IIA04b	How many of your employees are part time

Appendix II: Data Assessments
Part A - Chain 1

Correlation of Reported Sales with Actual (MIS) Sales

- - Correlation Coefficients - -

	SUBSALES	TOTAL_SA
SUBSALES	1.0000	.8623
	(69)	(69)
	P= .	P= .000
TOTAL_SA	.8623	1.0000
	(69)	(101)
	P= .000	P= .

(Coefficient / (Cases) / 2-tailed Significance)

" . " is printed if a coefficient cannot be computed

Correlation of Reported Size with Actual (MIS) Size

- - Correlation Coefficients - -

	TOTAL_SE	IIIB02
TOTAL_SE	1.0000	.9168
	(101)	(71)
	P= .	P= .000
IIIB02	.9168	1.0000
	(71)	(71)
	P= .000	P= .

(Coefficient / (Cases) / 2-tailed Significance)

" . " is printed if a coefficient cannot be computed

Correlation of Reported Inventory With Actual (MIS) Inventory

- - Correlation Coefficients - -

	TOTAL_IN	SUB_INVT
TOTAL_IN	1.0000	.7022
	(95)	(67)
	P= .	P= .000
SUB_INVT	.7022	1.0000
	(67)	(71)
	P= .000	P= .

(Coefficient / (Cases) / 2-tailed Significance)

" . " is printed if a coefficient cannot be computed

Regression Results for Reported Store Size on Actual (MIS) Store Size.

Listwise Deletion of Missing Data

Equation Number 1 Dependent Variable.. IIIB02 Total Selling Space of Stor

Block Number 1. Method: Enter TOTAL_SE

Variable(s) Entered on Step Number
1.. TOTAL_SE Total Selling Space

Multiple R	.91682
R Square	.84056
Adjusted R Square	.83825
Standard Error	829.53014

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	250312280.02776	250312280.02776
Residual	69	47480296.95816	688120.24577

F = 363.76241 Signif F = .0000

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
TOTAL_SE	.933741	.048957	.916820	19.073	.0000
(Constant)	384.103837	342.260337		1.122	.2656

End Block Number 1 All requested variables entered.

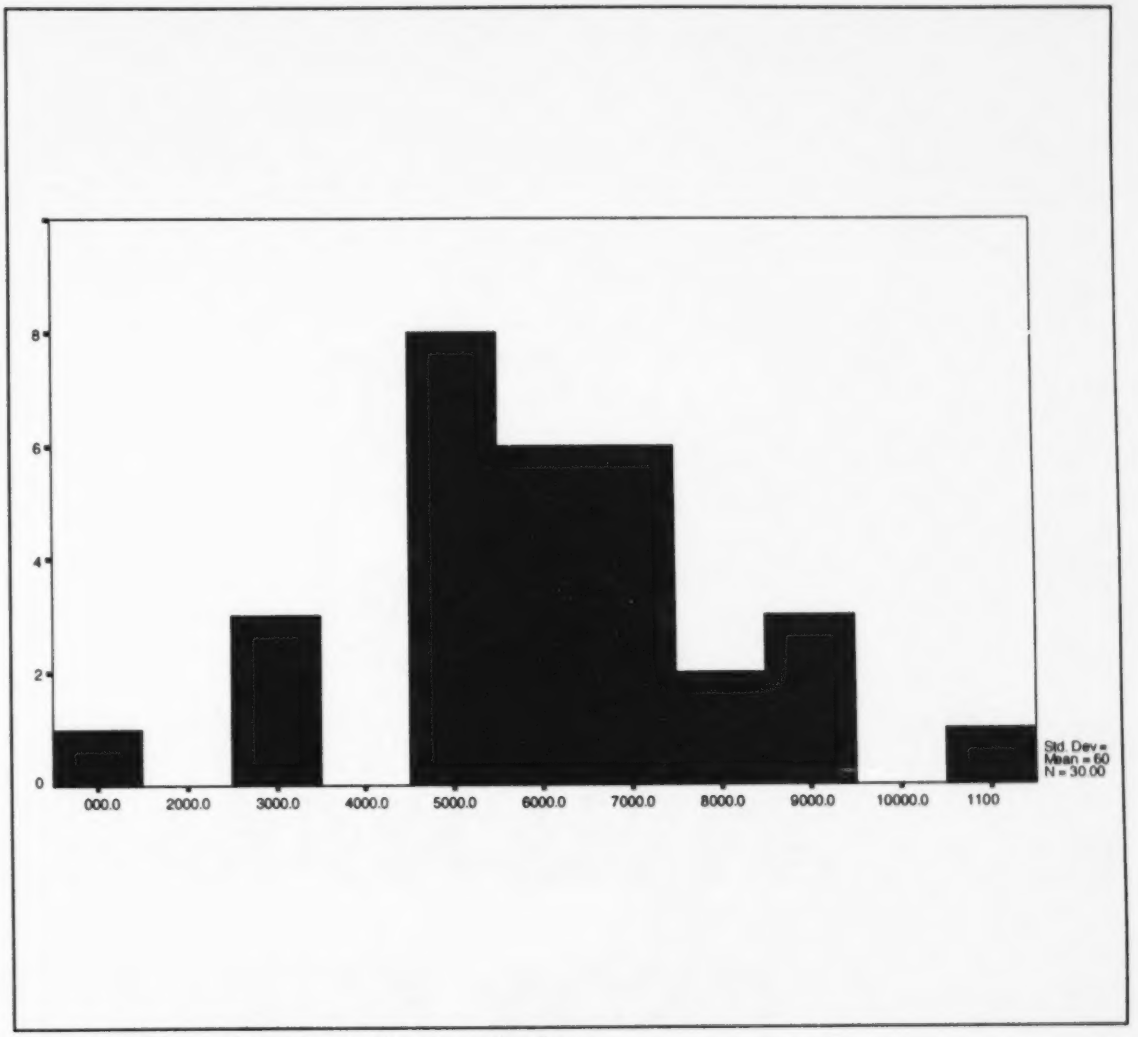

Figure 11 Histogram of Store Size for Non Responding Stores

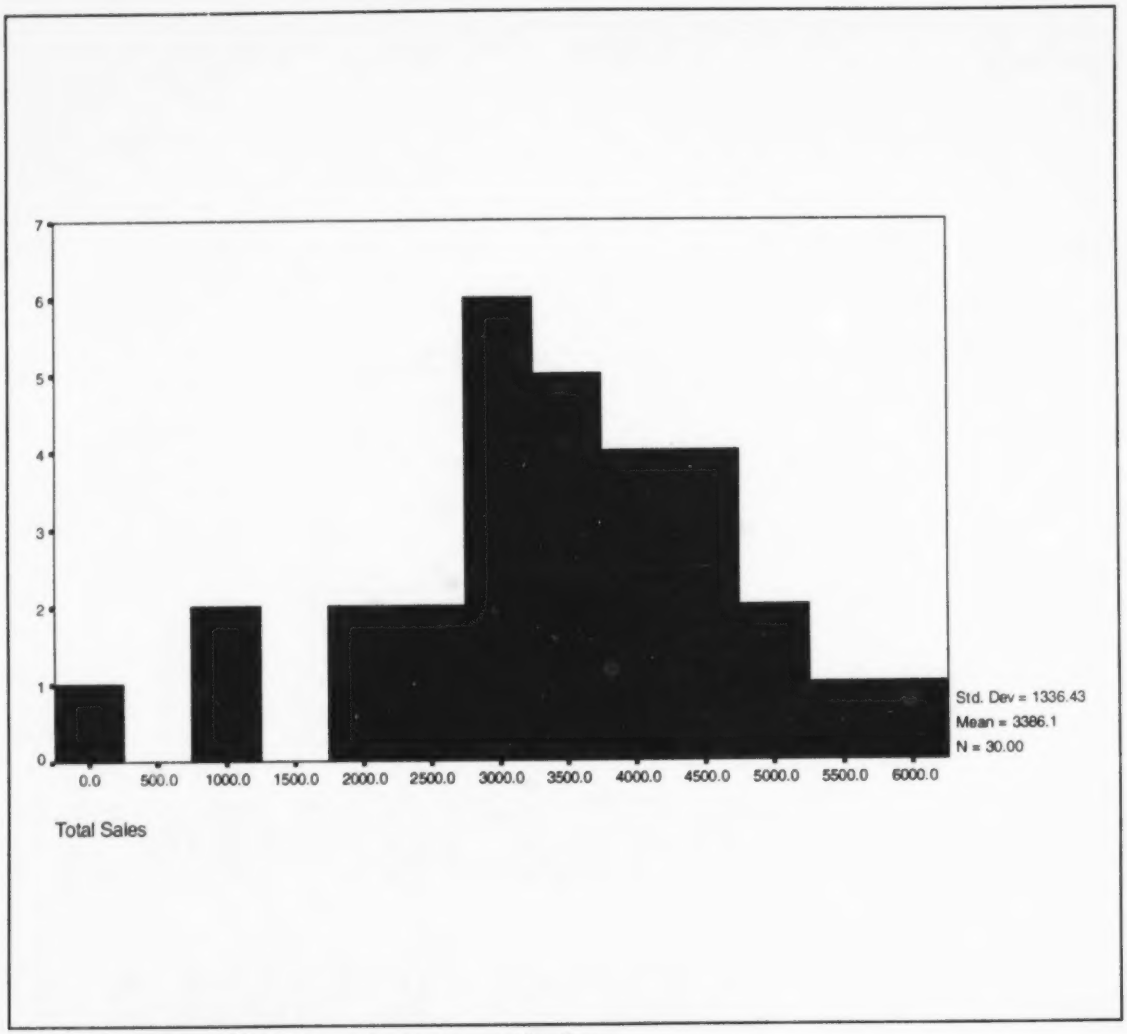

Figure 12 Histogram of Sales Figures for Non Responding Stores

Appendix III: Scale Factor Analysis Results and Pooling Results

Analysis number 1 Listwise deletion of cases with missing values
Chain 1 Variables Included in Analysis
Variable IIA05 excluded due to poor data - missing values and incorrect interpretation of question.

	Mean	Std Dev	Label
IA01	4.30645	1.36212	Uncertainty Regarding Sales Trend
IA02	3.96774	1.37862	Uncertainty Regarding Business Cycle
IA03	5.03226	1.49280	Deal Buying
IA04	3.95161	1.34807	Declining Demand
IA05	6.01613	.89611	Price Competition
IA06	5.43548	1.40981	Competition Based on Location
IA07	4.98387	1.18033	Competition on Selection
IA08	4.62903	1.57057	Competition on Quality
IA09	5.67742	1.56576	Competition on Service
IA10	5.14516	1.27841	Competition on Advertising
IA11	3.93548	1.67793	Periods of Low Service Levels
IA12	2.62903	1.24445	Periods of Labour Scarcity
IA13	3.82258	1.60454	Periods of Capital Scarcity
IB01	4.90323	1.12657	Price Reductions
IB02	4.80645	1.61792	Sales Promotion Campaigns
IB03	4.83871	1.54913	Advertising and Publicity Campaigns
IB04	3.67742	1.44601	Technological Changes
IB05	5.46774	1.09721	Service Improvements
IB06	4.91935	1.23206	Changes in Selection
IB07	4.24194	1.28912	Changes in Quality
IC01	4.09677	1.38741	Business Climate: Volume
IC02	4.22581	1.27291	Business Climate: Projections
IC03	4.14516	1.23934	Business Climate: Predictability
ID01	3.82258	1.55262	Demographic Characteristics
ID02	3.69355	1.28788	Preferred Variety
ID03	3.20968	1.18926	Product Value Preferences
IF01	3.70968	1.65348	Economic Growth Potential
IF02	5.08065	.94606	Demand for House Brands
IF03	4.95161	.99881	General Demand Conditions
IG01	3.96774	1.44821	New/Extended Products
IG02	4.58065	1.38550	House Brands
IG03	4.00000	1.26750	Items not Carried
IG04	5.16129	1.30815	Advertised Items
IG05	2.64516	1.07271	Environmentally Friendly Items
IG06	5.51613	1.23795	Sale Priced Items
IIA01	30.85484	9.67309	Total Employees
IIA04A	14.67742	5.71387	Full Time Employees
IIA04B	16.20968	7.13830	Part Time Employees
IIA05	84.41935	20.09999	Hours Open Per Week
IIA07	5.95161	1.06243	Management Team Size
IIA08	5.96774	1.39046	Number of Check-Outs
IIIA01	3.91935	1.17764	Total Value of Facilities
IIIA02	3.95161	1.27302	Total Dollars Invested
IIIA03	4.11290	1.17494	Number of SKUs Cosmetics
IIIA04	4.16129	1.14796	Number of SKUs TFS
IIIA05	3.79032	1.57997	Number of Cosmetic Transactions
IIIA06	4.08065	1.46319	Number of TFS Transactions
IIIA07	4.04839	1.15130	Dollar Value of Inventory TFS
IIIA08	4.09677	1.23752	Dollar Value of Inventory Cosmetics
IIIB02	6538.50000	2116.50913	Total Selling Space of Store
IV01	3.93548	1.61825	Cosmetics Sales
IV02	4.22581	1.47570	Pharmacy Sales
IV03	4.08065	1.38254	TFS Sales
IV04	4.25806	1.11525	Cosmetics Margin
IV05	4.48387	1.22464	Pharmacy Margin
IV06	4.51613	1.00396	TFS Margin

Number of Cases = 62

VARIMAX converged in 68 iterations. Factor Analysis for Chain 1, 62 Observations, 56 Variables

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
IV03	.86212				
IIIA06	.83060				
IIA01	.82163				
IIIA05	.80822			.39381	
IV01	.78840			.33090	
IIA08	.73645				
IIIA08	.72529			.41979	
IIIA07	.70979	-.31430			
IIIA03	.64505			.50295	
IIA04B	.62202				
IIA04A	.61263				
IIIA04	.48172				
IIIA01	.44106	-.34642			
IG04		.86927			
IG06		.86887			
IIIB02	.46730	-.47644		-.32021	
IG05		.47140			
IB06			.74842		
IB04			.70750		
IB07			.68102		
IB05			.58697		
ID02				.76819	
ID03				.76713	
ID01				.63497	
IC03					.88491
IC02					.86503
IC01					-.48632
IF02					
IG02			.46609		
IG01			.35554		
IF03		.33948			
IIA07					
IA07					
IA09					
IA13					
IA08					.32276
IA01					
IA02					
IV06					
IV05					-.32892
IV02					
IB03			.33756		
IB02	-.30567				
IV04	.32512				
IA12					
IF01					
IA06					
IA05					
IA03			.46784		
IIA05					
IB01					
IA11					
IA04					
IIIA02	.37452				-.32119
IA10					
IG03					

	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10
IV03					
IIIA06					
IIA01	-.33307				
IIIA05					
IV01					
IIA08					
IIIA08					
IIIA07					
IIIA03					
IIA04B	-.31381				
IIA04A					-.37057
IIIA04				.32393	
IIIA01					
IG04					
IG06					
IIIB02					
IG05				-.32456	
IB06					
IB04					
IB07					
IB05					
ID02					
ID03					
ID01					
IC03					
IC02					
IC01			.44120		
IF02	.77154				
IG02	.58825				
IG01	.54065				
IF03	.52338				
IIA07	-.50692				
IA07		.87294			
IA09		.71835			
IA13		.49208			
IA08		.47244			
IA01			.82744	-.30256	
IA02			.82494		
IV06				.76526	
IV05				.68538	
IV02				.45321	
IB03					.74007
IB02					.71222
IV04				.34951	.43921
IA12		.32842		.31599	.41550
IF01					
IA06		.38416			
IA05					
IA03			-.33271		
IIA05	-.35218				
IB01					
IA11					
IA04			.31179		
IIIA02					
IA10		.34500			
IG03			.41246		

	Factor 11	Factor 12	Factor 13	Factor 14	Factor 15
IV03					
IIIA06					
IIA01					
IIIA05					
IV01					
IIA08					.39549
IIIA08					
IIIA07					
IIIA03					
IIA04B					
IIA04A					
IIIA04			.35840		
IIIA01			-.43785		
IG04					
IG06					
IIIB02					
IG05	.46731				
IB06					
IB04					
IB07				.42986	
IB05					
ID02					
ID03					
ID01					
IC03					
IC02					
IC01			-.34208		
IF02					
IG02					
IG01	.35431				
IF03					
IIA07			.32156		
IA07					
IA09					
IA13		.39078			
IA08					
IA01					
IA02					
IV06					
IV05					
IV02					
IB03					
IB02			.30340		
IV04	.34745				
IA12					
IF01	.79759				
IA06	-.49343	.33649			
IA05		.69587			
IA03		.50380			
IIA05		-.40664			-.39113
IB01			.82857		
IA11				.65905	
IA04	-.45421			.61069	
IIIA02				.41494	
IA10					.78705
IG03					

Factor 16

IV03	
IIIA06	
IIA01	
IIIA05	
IV01	
IIA08	
IIIA08	
IIIA07	
IIIA03	
IIA04B	.40360
IIA04A	
IIIA04	
IIIA01	
IG04	
IG06	
IIIB02	
IG05	
IB06	
IB04	
IB07	
IB05	
ID02	
ID03	
ID01	
IC03	
IC02	
IC01	
IF02	
IG02	
IG01	
IF03	
IIA07	
IA07	
IA09	
IA13	
IA08	
IA01	
IA02	
IV06	
IV05	
IV02	
IB03	
IB02	
IV04	
IA12	-.33779
IF01	
IA06	
IA05	
IA03	
IIA05	
IB01	
IA11	
IA04	
IIIA02	
IA10	
IG03	.62300

Analysis number 1 Listwise deletion of cases with missing values
Chain 2 Variables Included in Analysis

Analysis number 1 Listwise deletion of cases with missing values

	Mean	Std Dev	Label
IB01	1.96226	1.30033	Pricing Changes
IB02	3.24528	2.31139	Sales Promotion Campaigns
IB03	2.98113	2.14378	Advertising Campaigns
IB04	3.05660	1.70311	Technological Changes
IB05	5.11321	1.84662	Service Improvements
IB06	4.32075	1.75163	Changes in Selection
IC01	3.45283	1.95690	Trend Uncertainty
IC02	3.07547	1.56708	Cycle Uncertainty
IC03	2.96226	1.23976	Demand Uncertainty
IC04	3.37736	1.63173	Forecast Uncertainty
IC05	4.13208	1.33067	Cycle Predictability
IC06	3.01887	1.93640	Competition Based on Deal Buying
IC07	4.28302	1.80147	Competition Based on Price
IC08	5.60377	1.43231	Competition Based on Location
IC09	5.56604	1.18499	Competition Based on Selection
IC10	5.26415	1.84131	Competition Based on Quality
IC11	5.49057	2.19810	Competition Based on Service
IC12	3.66038	1.98013	Competition Based on Advertising
IC13	3.33962	1.95077	Stock Scarcity
IC14	2.24528	1.49236	Labour Scarcity
IC15	2.64151	1.72197	Capital Scarcity
ID01	4.54717	1.87664	Demographics
ID02	3.58491	1.61047	Preferred Variety
ID03	3.49057	1.67128	Product Value Preferences
IF01	4.56604	1.42112	Economic Growth Potential
IF02	5.22642	1.56453	Brand Recognition
IF03	4.77358	1.08560	General Demand Conditions
IG01	4.60377	1.53597	New Products - Comment
IG02	3.26415	1.38884	Non Chain Brands - Comment
IG03	3.90566	1.59644	Discontinued Items - Comment
IG04	3.37736	1.50928	Similar Products - Comment
IG05	2.50943	1.55195	Advertised Items - Comment
IG06	4.37736	1.53456	Environmentally Responsible - Comment
IG07	3.37736	1.70098	Sale Priced Items - Comment
IIA1	8.13208	3.21677	Total Employees
IIA3A	3.62264	1.83163	Full Time Employees
IIA3B	4.52830	2.44638	Part Time Employees
IIA4	64.36792	5.92432	Hours Open
IIA5A	8.25774	2.85606	Wages Paid to Employees
IIA6	1.90566	1.13110	Management Team Size
IIA7	1.96226	.58711	Number of Tills
IIIA01	4.07547	.82855	Value of Facilities
IIIA02	4.30189	1.27980	Dollars Invested
IIIA03	4.15094	.36142	SKUs Colourings
IIIA04	4.01887	.69311	SKUs Above Neck
IIIA05	4.11321	.80049	SKUs Below Neck
IIIA06	4.28302	1.29165	Colourings Transactions
IIIA07	4.18868	.98169	Above the Neck Transactions
IIIA08	4.24528	.97873	Below Neck Transactions
IIIA09	3.75472	1.12499	Above Neck - Dollar Inventory
IIIA10	3.84906	1.24648	Below Neck - Dollar Inventory
IIIA11	3.90566	1.00507	Colourings - Dollar Inventory
IIIB2	810.01887	188.12920	Selling Space
IV01	4.15094	1.40598	Colourings Sales
IV02	4.13208	1.22534	Above Neck Sales
IV03	4.26415	1.17916	Below Neck Sales
IV04	3.94340	.74460	Colourings Margin
IV05	4.22642	.72434	Above Neck Margin
IV06	4.18868	.68097	Below Neck Margin

Number of Cases = 53

VARIMAX converged in 19 iterations. Analysis of Chain 2 data. 53 Observations Listwise Deletion.

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
IV03	.87387				
IIIA08	.84106				
IV02	.83916				
IIIA07	.83301				
IV01	.74005			-.30798	
IIA3A	.68928				
IIA1	.63523				
IIIA06	.57551			-.50019	
IIIA05		.84909			
IIIA04		.79945			
IIIA09	.46160	.69340			
IIIB2		.66561			
IIIA10	.46772	.66524			
IIIA01		.59586			-.31643
IIIA11	.43310	.57281		.30953	
IIIA02		.52367			
IC01			.85712		
IC02			.85470		
IC03			.80218		
IC04			.67336		
IG07			.47620		
IC05		.39932	.45872		
IIIA03			.38153		
IB04				.79656	
IB05				.78385	
IB06				.71144	
IC10					.86182
IC11					.84140
IC09					.79985
IC08					.76179
IF02	.33266				
IF03	.44852				
IG06					
IG01					
ID03					
ID02					
ID01					
IIA6	.39996				
IC07					
IC12					
IC06			.36330	.30890	
IC15			.43685		
IC13					
IC14	-.32470				
IG03					
IG02					
IB01				.32105	
IG04			.30348		
IIA3B	.31861				
IV04					
IV06	.53299			.32960	
IV05	.51200			.31797	
IB03					
IB02					
IIA5A					
IIA4	.36697				
IIA7	.40658				
IG05					
IF01					

	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10
IV03					
IIIA08					
IV02					
IIIA07					
IV01					
IIA3A					
IIA1					
IIIA06					
IIIA05					
IIIA04					
IIIA09					
IIIB2		-.31108			
IIIA10					
IIIA01					.30046
IIIA11					
IIIA02					
IC01					
IC02					
IC03					
IC04					
IG07				.32518	
IC05					
IIIA03					
IB04					
IB05					
IB06					
IC10					
IC11					
IC09					
IC08	.34741				
IF02	.73834				
IF03	.73095				
IG06	.69940				
IG01	.52910	.31750			
ID03		.80876			
ID02		.70248			.31741
ID01		.69925			
IIA6	.30647	.50091			
IC07			.80450		
IC12			.73284		
IC06			.48462	.46610	
IC15			.44519	.41771	
IC13				.77394	
IC14				.70883	
IG03					.74225
IG02			.33659		.64987
IB01					.56138
IG04			.31163		.46384
IIA3B				-.31421	
IV04					
IV06					
IV05					
IB03					
IB02					
IIA5A					
IIA4	.30705				
IIA7					
IG05					
IF01					

	Factor 11	Factor 12	Factor 13	Factor 14	Factor 15
IV03					
IIIA08					
IV02					
IIIA07					
IV01					
IIA3A					.34320
IIA1	.61370				
IIIA06					
IIIA05					
IIIA04					
IIIA09					
IIIB2					
IIIA10					
IIIA01					
IIIA11	-.40173				
IIIA02	.47384				
IC01					
IC02					
IC03					
IC04					
IG07	.35487				
IC05					
IIIA03					
IB04					
IB05					
IB06					
IC10					
IC11					
IC09					
IC08					
IF02					
IF03					
IG06					
IG01					.41293
ID03					
ID02					
ID01				.30164	
IIA6	.37504				
IC07					
IC12					
IC06					
IC15			.35214		
IC13					
IC14					
IG03					
IG02					
IB01			.38737		
IG04		-.38768			
IIA3B	.75853				
IV04		.75921			
IV06		.66370			
IV05		.66255			
IB03			.82656		
IB02			.82584		
IIA5A				.86078	
IIA4		.30069		.56679	
IIA7					.60521
IG05				.30683	.48831
IF01					

Factor 16

IV03	
IIIA08	
IV02	
IIIA07	
IV01	
IIA3A	
IIA1	
IIIA06	
IIIA05	
IIIA04	
IIIA09	
IIIB2	
IIIA10	
IIIA01	
IIIA11	
IIIA02	
IC01	
IC02	
IC03	
IC04	
IG07	
IC05	
IIIA03	.35674
IB04	
IB05	
IB06	
IC10	
IC11	
IC09	
IC08	
IF02	
IF03	
IG06	
IG01	
ID03	
ID02	
ID01	
IIA6	
IC07	
IC12	
IC06	
IC15	
IC13	
IC14	
IG03	
IG02	
IB01	
IG04	
IIA3B	
IV04	
IV06	
IV05	
IB03	
IB02	
IIA5A	
IIA4	
IIA7	
IG05	
IF01	.67059

Analysis number 1 Listwise deletion of cases with missing values
Variables in Factor Analysis for Kiwi Chemists data.

	Mean	Std Dev	Label
IB01	4.52597	1.50655	Pricing Changes
IB02	4.70130	1.49975	Sales Promotion Campaigns
IB03	4.82792	1.48815	Advertising Campaigns
IB04	4.66558	1.46907	Technological Changes
IB05	5.29221	1.25262	Service Improvements
IB06	4.76299	1.24479	Changes in Selection
IC01	4.33442	1.51492	Trend Uncertainty
IC02	4.12338	1.51573	Cycle Uncertainty
IC03	4.12662	1.42118	Demand Uncertainty
IC04	4.22078	1.52609	Forecast Uncertainty
IC05	4.38312	1.44022	Cycle Predictability
IC06	4.43182	1.42519	Competition Based on Deal Buying
IC07	4.33766	1.39202	Competition Based on Price
IC08	5.38312	1.62712	Competition Based on Location
IC09	4.86364	1.35333	Competition Based on Selection
IC10	4.84091	1.56634	Competition Based on Quality
IC11	5.57143	1.53082	Competition Based on Service
IC12	4.27273	1.45182	Competition Based on Advertising
ID01	4.19805	1.69202	Demographics
ID02	4.34091	1.64743	Lifestyle Characteristics
ID03	4.16234	1.33590	Preferred Variety
ID04	4.01623	1.46281	Product Value Preferences
IF01	3.76623	1.61141	Economic Growth Potential
IF02	3.47727	1.44028	Demand For House Brands
IF03	4.07468	1.23900	General Demand Conditions
IG01	4.18182	1.37665	New Products - Comment
IG02	2.84740	1.32605	House Brands - Comment
IG03	2.94156	1.13423	Unstocked Items - Comment
IG04	4.76948	1.25383	Advertised Items - Comment
IG05	3.14610	1.39149	Environmentally Responsible - Comment
IG06	3.94156	1.50455	Sale Priced Items - Comment
IIA1	6.83182	5.35040	Total Employees
IIA4A	4.20130	3.57403	Full Time Employees
IIA4B	2.66721	2.39104	Part Time Employees
IIA7	1.96672	1.16961	Management Team Size
IIA8	1.89610	1.00272	Number of Tills
IIIA01	4.32143	1.38062	Value of Facilities
IIIA02	4.32792	1.38616	Dollars Invested
IIIA03	3.54870	1.54864	SKUs Cosmetics
IIIA04	4.24351	1.38246	SKUs Total Front Store
IIIA05	3.58442	1.59886	Cosmetics Transactions
IIIA06	4.28571	1.37552	Total Front Store Transactions
IIIA07	4.21429	1.44594	Total Front Store - Dollar Inventory
IIIA08	3.63312	1.63187	Cosmetics - Dollar Inventory
NEWSPACE	92.16453	59.45589	Selling Space in Metres Squared!
IV01	3.49351	1.67467	Cosmetics Sales
IV02	4.55844	1.29387	Pharmacy Sales
IV03	4.42208	1.45411	Total Front Store Sales
IV04	3.74675	1.24551	Cosmetics Margin
IV05	4.41558	1.09307	Pharmacy Margin
IV06	4.28571	1.09909	Total Front Store Margin

Number of Cases = 308

VARIMAX converged in 13 iterations. **Kiwi Chemists Data Set.** 308 observations after listwise deletion.

Rotated Factor Matrix:

	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
IIIA08	.88200				
IIIA03	.87000				
IIIA05	.84931				
IV01	.82371				
IIIA07	.80010				
IIIA04	.74637				
IV03	.72493				
IIIA06	.72144				
IIIA01	.69537				
IIIA02	.68139				
IIA8	.62088			.49940	
IV04	.60506				
IV02	.53208				
IC04		.85008			
IC03		.83804			
IC02		.83746			
IC01		.80245			
ID02			.87401		
ID01			.87306		
ID04			.78655		
ID03			.74996		
IIA1	.51284			.77870	
IIA4B				.73114	
IIA4A	.56901			.67102	
IIA7				.47695	
IB02					.80417
IB03					.78377
IB01					.71164
IC10					
IC11					
IC09					
IC07					
IC06					
IC08					
IC12					
IG01					
IG04					
IG05					
IG02					
IG06					.42230
IV05					
IV06					
IB05					
IB04					
IB06					.33513
IF03					
IF01					
IF02					
NEWSPACE					
IG03					
IC05		.44301			

	Factor 6	Factor 7	Factor 8	Factor 9	Factor 10
IIIA08					
IIIA03					
IIIA05					
IV01					
IIIA07					
IIIA04					
IV03				.30666	
IIIA06					
IIIA01					
IIIA02					
IIA8					
IV04					
IV02				.47723	
IC04					
IC03					
IC02					
IC01					
ID02					
ID01					
ID04					
ID03					
IIA1					
IIA4B					
IIA4A					
IIA7					
IB02					
IB03					
IB01					
IC10	.86640				
IC11	.80188				
IC09	.62107	.41998			
IC07		.78405			
IC06		.69872			
IC08	.47648	.50844			
IC12		.48208			
IG01			.67154		
IG04			.65922		
IG05			.64205		.36321
IG02			.53307		
IG06			.44484		
IV05				.87963	
IV06				.82396	
IB05					.77134
IB04					.74566
IB06					.59222
IF03					
IF01					
IF02					
NEWSPACE					
IG03					
IC05					

	Factor 11	Factor 12	Factor 13
IIIA08			
IIIA03			
IIIA05			
IV01			
IIIA07			
IIIA04			
IV03			
IIIA06			
IIIA01			
IIIA02			
IIA8			
IV04			.48688
IV02			
IC04			
IC03			
IC02			
IC01			
ID02			
ID01			
ID04			
ID03			
IIA1			
IIA4B			
IIA4A			
IIA7			
IB02			
IB03			
IB01			
IC10			
IC11			
IC09			
IC07			
IC06			
IC08			
IC12			
IG01			
IG04			.30380
IG05			
IG02			
IG06			
IV05			
IV06			
IB05			
IB04			
IB06			
IF03	.71239		
IF01	.69468		
IF02	.60425		
NEWSPACE		.60595	
IG03		-.60316	
IC05		.45051	

Results for Pooling Tests - Productivity Measures

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* * * * * * A n a l y s i s   o f   V a r i a n c e * * * * * *


      126 cases accepted.
        0 cases rejected because of out-of-range factor values.
       86 cases rejected because of missing data.
        2 non-empty cells.

        1 design will be processed.

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

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* * * * * * A n a l y s i s   o f   V a r i a n c e -- design   1 * * * * * *

EFFECT .. FIRM
Multivariate Tests of Significance (S = 1, M = 2 , N = 58 1/2)

Test Name          Value    Exact F Hypoth. DF   Error DF  Sig. of F

Pillais          .91366  209.88948       6.00     119.00       .000
Hotellings     10.58266  209.88948       6.00     119.00       .000
Wilks            .08634  209.88948       6.00     119.00       .000
Roys             .91366
Note.. F statistics are exact.

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
EFFECT .. FIRM (Cont.)
Univariate F-tests with (1,124) D. F.

Variable   Hypoth. SS   Error SS Hypoth. MS   Error MS          F  Sig. of F

PRMGCAPT       .17527   21.12539     .17527     .17037    1.02879       .312
PRMGLABR      5.11423    4.03982    5.11423     .03258  156.97851       .000
PRMGSPAC       .00069     .00014     .00069     .00000  619.81666       .000
PRSACAPT       .04856   12.39524     .04856     .09996     .48576       .487
PRSALABR      5.24942    2.78549    5.24942     .02246  233.68513       .000
PRSASPAC       .00072     .00020     .00072     .00000  457.82295       .000

- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -

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Appendix IV: Regression Results

Hypotheses 1a and 1b

**** MULTIPLE REGRESSION ****

Listwise Deletion of Missing Data **New Zealand Data**

Equation Number 1 Dependent Variable.. PRODLBSA Sales Productivity of Lab

Block Number 1. Method: Enter ZNEWSPAC ZZNEWSPS

Variable(s) Entered on Step Number
1.. ZZNEWSPS Zscore(ZNEWSPSQ)
2.. ZNEWSPAC Zscore: Selling Space in Metres Squared

Multiple R	.23309
R Square	.05433
Adjusted R Square	.04870
Standard Error	.55081

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	2	5.85661	2.92831
Residual	336	101.93799	.30339

F = 9.65205 Signif F = .0001

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
ZNEWSPAC	.026799	.035957	.044785	.745	.4566
ZZNEWSPS	-.286837	.068739	-.250744	-4.173	.0000
(Constant)	1.292991	.030145		42.893	.0000

End Block Number 1 All requested variables entered.

**** MULTIPLE REGRESSION ****

Listwise Deletion of Missing Data **New Zealand Data**

Equation Number 1 Dependent Variable.. PRODLBMG Margin Productivity of La

Block Number 1. Method: Enter ZNEWSPAC ZZNEWSPS

Variable(s) Entered on Step Number
1.. ZZNEWSPS Zscore(ZNEWSPSQ)
2.. ZNEWSPAC Zscore: Selling Space in Metres Squared

Multiple R	.22439
R Square	.05035
Adjusted R Square	.04473
Standard Error	.70328

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	2	8.86391	4.43195
Residual	338	167.17451	.49460

F = 8.96070 Signif F = .0002

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
ZNEWSPAC	-.044882	.045814	-.059535	-.980	.3280
ZZNEWSPS	-.271919	.087352	-.189180	-3.113	.0020
(Constant)	1.412579	.038314		36.869	.0000

End Block Number 1 All requested variables entered.

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *
Listwise Deletion of Missing Data     New Zealand Data

Equation Number 1    Dependent Variable..   PRODCPSA   Sales Productivity of Cap

Block Number  1.  Method:  Enter      ZNEWSPAC ZZNEWSPS

Variable(s) Entered on Step Number
   1..     ZZNEWSPS  Zscore(ZNEWSPSQ)
   2..     ZNEWSPAC  Zscore:  Selling Space in Metres Squared

Multiple R            .06293
R Square              .00396
Adjusted R Square    -.00048
Standard Error        .23484

Analysis of Variance
                    DF        Sum of Squares        Mean Square
Regression           2              .09845              .04922
Residual           449            24.76142              .05515

F =         .89256       Signif F =  .4103

------------------ Variables in the Equation ------------------

Variable               B         SE B        Beta           T  Sig T

ZNEWSPAC         -.011919      .013648   -.046245      -.873  .3829
ZZNEWSPS         -.012998      .025981   -.026491      -.500  .6171
(Constant)      1.012540      .011216                90.278  .0000

End Block Number   1   All requested variables entered.
```

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     New Zealand Data

Equation Number 1    Dependent Variable..   PRODCPMG   Margin Productivity of Ca

Block Number  1.  Method:  Enter      ZNEWSPAC ZZNEWSPS


Variable(s) Entered on Step Number
   1..     ZZNEWSPS  Zscore(ZNEWSPSQ)
   2..     ZNEWSPAC  Zscore:  Selling Space in Metres Squared


Multiple R            .22995
R Square              .05287
Adjusted R Square     .04864
Standard Error        .38529

Analysis of Variance
                    DF        Sum of Squares        Mean Square
Regression           2             3.70436             1.85218
Residual           447            66.35475              .14844

F =      12.47723       Signif F =  .0000


------------------ Variables in the Equation ------------------

Variable               B         SE B        Beta           T  Sig T

ZNEWSPAC         -.099627      .022438   -.231448     -4.440  .0000
ZZNEWSPS          .002666      .042886    .003241      .062  .9505
(Constant)      1.113532      .018408                60.491  .0000

End Block Number   1   All requested variables entered.
```

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 1 Data

Equation Number 1    Dependent Variable..   PRSALABR   Sales Productivity of Lab

Block Number  1.  Method:  Enter      ZIIIB02  ZZIIIB2S


Variable(s) Entered on Step Number
   1..     ZZIIIB2S  Zscore:  Square of Normalised Space Meas
   2..     ZIIIB02   Zscore:  Total Selling Space of Store


Multiple R            .25261
R Square              .06381
Adjusted R Square     .03361
Standard Error        .04818

Analysis of Variance
                    DF       Sum of Squares       Mean Square
Regression           2              .00981              .00490
Residual            62              .14392              .00232

F =       2.11297       Signif F =  .1295


------------------ Variables in the Equation ------------------

Variable              B         SE B       Beta          T  Sig T

ZIIIB02         -.017654      .009403   -.231470     -1.877  .0652
ZZIIIB2S         .027590      .040456    .084081       .682  .4978
(Constant)       .242602      .008727                27.799  .0000


End Block Number   1   All requested variables entered.

* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 1 Data

Equation Number 1    Dependent Variable..   PRMGLABR   Margin Productivity of la

Block Number  1.  Method:  Enter      ZIIIB02  ZZIIIB2S


Variable(s) Entered on Step Number
   1..     ZZIIIB2S  Zscore:  Square of Normalised Space Meas
   2..     ZIIIB02   Zscore:  Total Selling Space of Store


Multiple R            .41701
R Square              .17390
Adjusted R Square     .14725
Standard Error        .07516

Analysis of Variance
                    DF       Sum of Squares       Mean Square
Regression           2              .07372              .03686
Residual            62              .35021              .00565

F =       6.52574       Signif F =  .0027


------------------ Variables in the Equation ------------------

Variable              B         SE B       Beta          T  Sig T

ZIIIB02         -.052778      .014668   -.416711     -3.598  .0006
ZZIIIB2S         .001927      .063107    .003536       .031  .9757
(Constant)       .266998      .013613                19.613  .0000


End Block Number   1   All requested variables entered.
```

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 1 Data

Equation Number 1    Dependent Variable..   PRSACAPT   Sales Productivity of Cap

Block Number  1.  Method:  Enter      ZIIIB02  ZZIIIB2S


Variable(s) Entered on Step Number
   1..    ZZIIIB2S  Zscore:  Square of Normalised Space Meas
   2..    ZIIIB02   Zscore:  Total Selling Space of Store


Multiple R            .05461
R Square              .00298
Adjusted R Square    -.02971
Standard Error        .23865

Analysis of Variance
                    DF        Sum of Squares        Mean Square
Regression           2              .01039              .00520
Residual            61             3.47426              .05696

F =         .09124       Signif F =  .9129


------------------ Variables in the Equation ------------------

Variable              B         SE B        Beta           T  Sig T

ZIIIB02         -.006002      .047370    -.016271      -.127  .8996
ZZIIIB2S         .079247      .201025     .050623       .394  .6948
(Constant)      1.001252      .043763                 22.879  .0000

End Block Number   1   All requested variables entered.

* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 1 Data

Equation Number 1    Dependent Variable..   PRMGCAPT   Margin Productivity of Ca

Block Number  1.  Method:  Enter      ZIIIB02  ZZIIIB2S


Variable(s) Entered on Step Number
   1..    ZZIIIB2S  Zscore:  Square of Normalised Space Meas
   2..    ZIIIB02   Zscore:  Total Selling Space of Store


Multiple R            .30583
R Square              .09353
Adjusted R Square     .06381
Standard Error        .20543

Analysis of Variance
                    DF        Sum of Squares        Mean Square
Regression           2              .26562              .13281
Residual            61             2.57438              .04220

F =        3.14697       Signif F =  .0500


------------------ Variables in the Equation ------------------

Variable              B         SE B        Beta           T  Sig T

ZIIIB02         -.102149      .040776    -.306740     -2.505  .0149
ZZIIIB2S        -.017442      .173043    -.012342      -.101  .9200
(Constant)      1.078582      .037672                 28.631  .0000

End Block Number   1   All requested variables entered.
```

```
          * * * *  M U L T I P L E   R E G R E S S I O N  * * * *
Listwise Deletion of Missing Data     Chain 2 Data

Equation Number 1    Dependent Variable..   PRSALABR   Sales Productivity of Lab

Block Number  1.  Method:  Enter      ZIIIB2   ZZIIIB2S


Variable(s) Entered on Step Number
   1..    ZZIIIB2S  Zscore:  normalised space squared = ziii
   2..    ZIIIB2    Zscore:  Selling Space


Multiple R            .03873
R Square              .00150
Adjusted R Square    -.03293
Standard Error        .30627

Analysis of Variance
                    DF        Sum of Squares      Mean Square
Regression           2              .00817             .00409
Residual            58             5.44033             .09380

F =        .04356       Signif F =  .9574


------------------ Variables in the Equation ------------------

Variable              B         SE B       Beta         T  Sig T

ZIIIB2          -.011200      .039930   -.037646     -.280  .7801
ZZIIIB2S         .005954      .039976    .019991      .149  .8821
(Constant)       .982152      .039259               25.017  .0000


End Block Number   1   All requested variables entered.


          * * * *  M U L T I P L E   R E G R E S S I O N  * * * *


Listwise Deletion of Missing Data     Chain 2 Data

Equation Number 1    Dependent Variable..   PRMGLABR   Margin Productivity of La

Block Number  1.  Method:  Enter      ZIIIB2   ZZIIIB2S


Variable(s) Entered on Step Number
   1..    ZZIIIB2S  Zscore:  normalised space squared = ziii
   2..    ZIIIB2    Zscore:  Selling Space


Multiple R            .11205
R Square              .01255
Adjusted R Square    -.02092
Standard Error        .34205

Analysis of Variance
                    DF        Sum of Squares      Mean Square
Regression           2              .08777             .04388
Residual            59             6.90303             .11700

F =        .37507       Signif F =  .6889


------------------ Variables in the Equation ------------------

Variable              B         SE B       Beta         T  Sig T

ZIIIB2          -.035039      .044259   -.104723     -.792  .4317
ZZIIIB2S        -.007953      .044589   -.023594     -.178  .8590
(Constant)      1.011213      .043534               23.228  .0000
End Block Number   1   All requested variables entered.
          * * * *  M U L T I P L E   R E G R E S S I O N  * * * *
```

Listwise Deletion of Missing Data **Chain 2 Data**

Equation Number 1 Dependent Variable.. PRSACAPT Sales Productivity of Cap

Block Number 1. Method: Enter ZIIIB2 ZZIIIB2S

Variable(s) Entered on Step Number
1.. ZZIIIB2S Zscore: normalised space squared = ziii
2.. ZIIIB2 Zscore: Selling Space

Multiple R .24482
R Square .05994
Adjusted R Square .02636
Standard Error .24784

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	2	.21933	.10966
Residual	56	3.43990	.06143

F = 1.78526 Signif F = .1772

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
ZIIIB2	-.062032	.033867	-.247355	-1.832	.0723
ZZIIIB2S	.032806	.034095	.129941	.962	.3401
(Constant)	1.069489	.032369		33.040	.0000

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **Chain 2 Data**

Equation Number 1 Dependent Variable.. PRMGCAPT Margin Productivity of Ca

Block Number 1. Method: Enter ZIIIB2 ZZIIIB2S

Variable(s) Entered on Step Number
1.. ZZIIIB2S Zscore: normalised space squared = ziii
2.. ZIIIB2 Zscore: Selling Space

Multiple R .44208
R Square .19543
Adjusted R Square .16670
Standard Error .18504

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	2	.46574	.23287
Residual	56	1.91736	.03424

F = 6.80133 Signif F = .0023

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
ZIIIB2	-.092256	.025295	-.455459	-3.647	.0006
ZZIIIB2S	.039392	.025421	.193512	1.550	.1269
(Constant)	1.060307	.024172		43.865	.0000

End Block Number 1 All requested variables entered.

Hypothesis 2: Capital Investment (Valuscal) related to productivity

* * * * MULTIPLE REGRESSION * * * *

Listwise Deletion of Missing Data **New Zealand Data**

Equation Number 1 Dependent Variable.. PRODLBSA Sales Productivity of Lab

Block Number 1. Method: Enter CAPITAL

Variable(s) Entered on Step Number
1.. CAPITAL Capital Scale = (IIIA01,02,03,04,07,08)/

Multiple R	.08640
R Square	.00746
Adjusted R Square	.00480
Standard Error	.56035

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.87842	.87842
Residual	372	116.80553	.31399

F = 2.79758 Signif F = .0952

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
CAPITAL	-.040146	.024002	-.086396	-1.673	.0952
(Constant)	1.473571	.100664		14.639	.0000

End Block Number 1 All requested variables entered.

* * * * MULTIPLE REGRESSION * * * *

Listwise Deletion of Missing Data **New Zealand Data**

Equation Number 1 Dependent Variable.. PRODLBMG Margin Productivity of La

Block Number 1. Method: Enter CAPITAL

Variable(s) Entered on Step Number
1.. CAPITAL Capital Scale = (IIIA01,02,03,04,07,08)/

Multiple R	.36621
R Square	.13411
Adjusted R Square	.13175
Standard Error	.66144

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	24.80065	24.80065
Residual	366	160.12525	.43750

F = 56.68710 Signif F = .0000

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
CAPITAL	-.216953	.028815	-.366212	-7.529	.0000
(Constant)	2.296939	.121221		18.948	.0000

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **New Zealand Data**

Equation Number 1 Dependent Variable.. PRODSPSA Sales Productivity of Spa

Block Number 1. Method: Enter CAPITAL

Variable(s) Entered on Step Number
1.. CAPITAL Capital Scale = (IIIA01,02,03,04,07,08)/

Multiple R	.12294
R Square	.01511
Adjusted R Square	.01297
Standard Error	.18956

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.25364	.25364
Residual	460	16.52839	.03593

F = 7.05899 Signif F = .0082

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
CAPITAL	.019288	.007259	.122938	2.657	.0082
(Constant)	.004271	.029684		.144	.8857

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **New Zealand Data**

Equation Number 1 Dependent Variable.. PRODSPMG Margin Productivity of Sp

Block Number 1. Method: Enter CAPITAL

Variable(s) Entered on Step Number
1.. CAPITAL Capital Scale = (IIIA01,02,03,04,07,08)/

Multiple R	.04481
R Square	.00201
Adjusted R Square	-.00017
Standard Error	.19323

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.03441	.03441
Residual	458	17.10044	.03734

F = .92164 Signif F = .3376

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
CAPITAL	.007172	.007470	.044814	.960	.3376
(Constant)	.057898	.030679		1.887	.0598

End Block Number 1 All requested variables entered.

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 1 Data

Equation Number 1    Dependent Variable..   PRSALABR   Sales Productivity of Lab

Block Number  1.  Method:  Enter      SUBCAPIT


Variable(s) Entered on Step Number
   1..    SUBCAPIT  Capital Scale = (iiia01 + iiia02 + iiia0


Multiple R            .34977
R Square              .12234
Adjusted R Square     .10904
Standard Error        .07842

Analysis of Variance
                    DF        Sum of Squares      Mean Square
Regression           1              .05657            .05657
Residual            66              .40587            .00615

F =       9.19983       Signif F =  .0035


------------------ Variables in the Equation ------------------

Variable              B         SE B       Beta          T  Sig T

SUBCAPIT        -.032040      .010563   -.349769     -3.033  .0035
(Constant)       .381774      .044980                8.488  .0000


End Block Number   1   All requested variables entered.


* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 1 Data

Equation Number 1    Dependent Variable..   PRMGLABR   Margin Productivity of la

Block Number  1.  Method:  Enter      SUBCAPIT


Variable(s) Entered on Step Number
   1..    SUBCAPIT  Capital Scale = (iiia01 + iiia02 + iiia0


Multiple R            .52005
R Square              .27045
Adjusted R Square     .25940
Standard Error        .17982

Analysis of Variance
                    DF        Sum of Squares      Mean Square
Regression           1              .79117            .79117
Residual            66             2.13416            .03234

F =      24.46718       Signif F =  .0000


------------------ Variables in the Equation ------------------

Variable              B         SE B       Beta          T  Sig T

SUBCAPIT        -.119818      .024223   -.520052     -4.946  .0000
(Constant)       .792454      .103142                7.683  .0000


End Block Number   1   All requested variables entered.
```

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **Chain 1 Data**

Equation Number 1 Dependent Variable.. PRSASPAC Sales Productivity of Spa

Block Number 1. Method: Enter SUBCAPIT

Variable(s) Entered on Step Number
1.. SUBCAPIT Capital Scale = (iiia01 + iiia02 + iiia0

Multiple R .05765
R Square .00332
Adjusted R Square -.01201
Standard Error 2.53389E-04

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.00000	.00000
Residual	65	.00000	.00000

F = .21677 Signif F = .6431

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
SUBCAPIT	-1.58962E-05	3.4142E-05	-.057653	-.466	.6431
(Constant)	7.28016E-04	1.4534E-04		5.009	.0000

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **Chain 1 Data**

Equation Number 1 Dependent Variable.. PRMGSPAC Margin Productivity of Sp

Block Number 1. Method: Enter SUBCAPIT

Variable(s) Entered on Step Number
1.. SUBCAPIT Capital Scale = (iiia01 + iiia02 + iiia0

Multiple R .40927
R Square .16750
Adjusted R Square .15470
Standard Error 3.98527E-04

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.00000	.00000
Residual	65	.00001	.00000

F = 13.07838 Signif F = .0006

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
SUBCAPIT	-1.94195E-04	5.3698E-05	-.409272	-3.616	.0006
(Constant)	.001561	2.2859E-04		6.828	.0000

End Block Number 1 All requested variables entered.

**** MULTIPLE REGRESSION ****

Listwise Deletion of Missing Data **Chain 2 Data**

Equation Number 1 Dependent Variable.. PRSALABR Sales Productivity of Lab

Block Number 1. Method: Enter CAPITAL

Variable(s) Entered on Step Number
1.. CAPITAL Capital Scale = (iiia01 + iiia02 + iiia0

Multiple R	.09936
R Square	.00987
Adjusted R Square	-.00691
Standard Error	.30277

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.05393	.05393
Residual	59	5.40855	.09167

F = .58832 Signif F = .4461

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
CAPITAL	-.045350	.059124	-.099363	-.767	.4461
(Constant)	1.159434	.242404		4.783	.0000

End Block Number 1 All requested variables entered.

**** MULTIPLE REGRESSION ****

Listwise Deletion of Missing Data **Chain 2 Data**

Equation Number 1 Dependent Variable.. PRMGLABR Margin Productivity of La

Block Number 1. Method: Enter CAPITAL

Variable(s) Entered on Step Number
1.. CAPITAL Capital Scale = (iiia01 + iiia02 + iiia0

Multiple R	.29716
R Square	.08830
Adjusted R Square	.07285
Standard Error	.32862

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.61711	.61711
Residual	59	6.37141	.10799

F = 5.71454 Signif F = .0200

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
CAPITAL	-.152553	.063816	-.297160	-2.391	.0200
(Constant)	1.618633	.261161		6.198	.0000

End Block Number 1 All requested variables entered.

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 2 Data

Equation Number 1     Dependent Variable..   PRSASPAC   Sales Productivity of Spa

Block Number  1.  Method:  Enter      CAPITAL


Variable(s) Entered on Step Number
   1..     CAPITAL    Capital Scale = (iiia01 + iiia02 + iiia0


Multiple R            .13694
R Square              .01875
Adjusted R Square     .00154
Standard Error  1.63867E-03

Analysis of Variance
                    DF        Sum of Squares        Mean Square
Regression           1               .00000               .00000
Residual            57               .00015               .00000

F =       1.08937        Signif F =  .3010


------------------ Variables in the Equation ------------------

Variable              B         SE B        Beta          T  Sig T

CAPITAL     -3.48647E-04  3.3404E-04    -.136943     -1.044  .3010
(Constant)       .006905      .001358                  5.085  .0000

End Block Number   1   All requested variables entered.

* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 2 Data

Equation Number 1     Dependent Variable..   PRMGSPAC   Margin Productivity of Sp

Block Number  1.  Method:  Enter      CAPITAL


Variable(s) Entered on Step Number
   1..     CAPITAL    Capital Scale = (iiia01 + iiia02 + iiia0


Multiple R            .40219
R Square              .16176
Adjusted R Square     .14705
Standard Error  1.35060E-03

Analysis of Variance
                    DF        Sum of Squares        Mean Square
Regression           1               .00002               .00002
Residual            57               .00010               .00000

F =      10.99959        Signif F =  .0016


------------------ Variables in the Equation ------------------

Variable              B         SE B        Beta          T  Sig T

CAPITAL     -9.08204E-04  2.7384E-04    -.402194     -3.317  .0016
(Constant)       .009050      .001111                  8.145  .0000

End Block Number   1   All requested variables entered.
```

Hypothesis 3 effect of competition on productivity

```
          * * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     New Zealand Data

Equation Number 1    Dependent Variable..   PRODLBSA   Sales Productivity of Lab

Block Number  1.  Method:  Enter      SRVCOMPT


Variable(s) Entered on Step Number
   1..     SRVCOMPT  Service Based Competition = IC09 to IC11


Multiple R            .01362
R Square              .00019
Adjusted R Square    -.00250
Standard Error        .55488

Analysis of Variance
                    DF       Sum of Squares       Mean Square
Regression           1              .02129              .02129
Residual           373           114.84192              .30789

F =         .06916       Signif F =  .7927

------------------ Variables in the Equation ------------------

Variable              B         SE B        Beta          T  Sig T

SRVCOMPT       -.005999      .022813    -.013615      -.263  .7927
(Constant)     1.341330      .119302                 11.243  .0000


End Block Number   1   All requested variables entered.


          * * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     New Zealand Data

Equation Number 1    Dependent Variable..   PRODLBMG   Margin Productivity of La

Block Number  1.  Method:  Enter      SRVCOMPT


Variable(s) Entered on Step Number
   1..     SRVCOMPT  Service Based Competition = IC09 to IC11


Multiple R            .10130
R Square              .01026
Adjusted R Square     .00761
Standard Error        .69991

Analysis of Variance
                    DF       Sum of Squares       Mean Square
Regression           1              1.89448             1.89448
Residual           373            182.72549              .48988

F =        3.86722       Signif F =  .0500

------------------ Variables in the Equation ------------------

Variable              B         SE B        Beta          T  Sig T

SRVCOMPT       -.057106      .029039    -.101299     -1.967  .0500
(Constant)     1.706816      .151981                 11.230  .0000
End Block Number   1   All requested variables entered.
```

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     New Zealand Data

Equation Number 1    Dependent Variable..   PRODCPSA   Sales Productivity of Cap

Block Number  1.  Method:  Enter      SRVCOMPT


Variable(s) Entered on Step Number
   1..    SRVCOMPT  Service Based Competition = IC09 to IC11


Multiple R            .03506
R Square              .00123
Adjusted R Square    -.00078
Standard Error        .23389

Analysis of Variance
                    DF        Sum of Squares      Mean Square
Regression           1              .03340            .03340
Residual           496            27.13438            .05471

F =         .61044       Signif F =  .4350

------------------ Variables in the Equation ------------------

Variable               B         SE B        Beta          T  Sig T

SRVCOMPT         .006367      .008149     .035060       .781  .4350
(Constant)       .981818      .042402                 23.155  .0000


End Block Number   1   All requested variables entered.


* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     New Zealand Data

Equation Number 1    Dependent Variable..   PRODCPMG   Margin Productivity of Ca

Block Number  1.  Method:  Enter      SRVCOMPT


Variable(s) Entered on Step Number
   1..    SRVCOMPT  Service Based Competition = IC09 to IC11


Multiple R            .12412
R Square              .01541
Adjusted R Square     .01340
Standard Error        .41298

Analysis of Variance
                    DF        Sum of Squares      Mean Square
Regression           1             1.31025           1.31025
Residual           491            83.74059            .17055

F =       7.68247       Signif F =  .0058

------------------ Variables in the Equation ------------------

Variable               B         SE B        Beta          T  Sig T

SRVCOMPT        -.040351      .014558    -.124119    -2.772  .0058
(Constant)      1.320181      .075912                17.391  .0000


End Block Number   1   All requested variables entered.
```

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **New Zealand Data**

Equation Number 1 Dependent Variable.. PRODSPSA Sales Productivity of Spa

Block Number 1. Method: Enter SRVCOMPT

Variable(s) Entered on Step Number
1.. SRVCOMPT Service Based Competition = IC09 to IC11

Multiple R	.10936
R Square	.01196
Adjusted R Square	.00982
Standard Error	.18938

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.20099	.20099
Residual	463	16.60622	.03587

F = 5.60389 Signif F = .0183

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
SRVCOMPT	-.016118	.006809	-.109356	-2.367	.0183
(Constant)	.161386	.035433		4.555	.0000

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **New Zealand Data**

Equation Number 1 Dependent Variable.. PRODSPMG Margin Productivity of Sp

Block Number 1. Method: Enter SRVCOMPT

Variable(s) Entered on Step Number
1.. SRVCOMPT Service Based Competition = IC09 to IC11

Multiple R	.13182
R Square	.01738
Adjusted R Square	.01528
Standard Error	.18982

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.29818	.29818
Residual	468	16.86245	.03603

F = 8.27569 Signif F = .0042

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
SRVCOMPT	-.019692	.006845	-.131817	-2.877	.0042
(Constant)	.185062	.035625		5.195	.0000

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **New Zealand Data**

Equation Number 1 Dependent Variable.. PRODLBSA Sales Productivity of Lab

Block Number 1. Method: Enter PRCCOMPT

Variable(s) Entered on Step Number
1.. PRCCOMPT Price based Competition = IC06,07,08,12

Multiple R	.07947
R Square	.00632
Adjusted R Square	.00366
Standard Error	.55420

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.73010	.73010
Residual	374	114.87086	.30714

F = 2.37707 Signif F = .1240

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
PRCCOMPT	.040499	.026268	.079471	1.542	.1240
(Constant)	1.122850	.124806		8.997	.0000

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **New Zealand Data**

Equation Number 1 Dependent Variable.. PRODLBMG Margin Productivity of La

Block Number 1. Method: Enter PRCCOMPT

Variable(s) Entered on Step Number
1.. PRCCOMPT Price based Competition = IC06,07,08,12

Multiple R	.05641
R Square	.00318
Adjusted R Square	.00051
Standard Error	.70425

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.59058	.59058
Residual	373	184.99401	.49596

F = 1.19077 Signif F = .2759

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
PRCCOMPT	-.036816	.033738	-.056411	-1.091	.2759
(Constant)	1.587172	.159970		9.922	.0000

End Block Number 1 All requested variables entered.

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     New Zealand Data

Equation Number 1    Dependent Variable..   PRODCPSA   Sales Productivity of Cap

Block Number  1.  Method:  Enter      PRCCOMPT


Variable(s) Entered on Step Number
   1..     PRCCOMPT  Price based Competition = IC06,07,08,12


Multiple R            .04791
R Square              .00230
Adjusted R Square     .00029
Standard Error        .23307

Analysis of Variance
                    DF        Sum of Squares        Mean Square
Regression           1              .06224              .06224
Residual           498            27.05128              .05432

F =       1.14577       Signif F =  .2850

------------------ Variables in the Equation ------------------

Variable              B         SE B        Beta          T  Sig T

PRCCOMPT        -.010186      .009516   -.047911     -1.070  .2850
(Constant)     1.059035      .045065                23.500  .0000


End Block Number   1   All requested variables entered.


* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     New Zealand Data

Equation Number 1    Dependent Variable..   PRODCPMG   Margin Productivity of Ca

Block Number  1.  Method:  Enter      PRCCOMPT


Variable(s) Entered on Step Number
   1..     PRCCOMPT  Price based Competition = IC06,07,08,12


Multiple R            .15737
R Square              .02477
Adjusted R Square     .02278
Standard Error        .41024

Analysis of Variance
                    DF        Sum of Squares        Mean Square
Regression           1              2.10274             2.10274
Residual           492             82.80237              .16830

F =      12.49421       Signif F =  .0004

------------------ Variables in the Equation ------------------

Variable              B         SE B        Beta          T  Sig T

PRCCOMPT        -.059864      .016936   -.157372     -3.535  .0004
(Constant)     1.391752      .080132                17.368  .0000


End Block Number   1   All requested variables entered.
```

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     New Zealand Data

Equation Number 1    Dependent Variable..   PRODSPSA   Sales Productivity of Spa

Block Number  1.  Method:  Enter      PRCCOMPT


Variable(s) Entered on Step Number
   1..    PRCCOMPT  Price based Competition - IC06,07,08,12


Multiple R            .07727
R Square              .00597
Adjusted R Square     .00383
Standard Error        .18963

Analysis of Variance
                 DF        Sum of Squares      Mean Square
Regression        1              .10044            .10044
Residual        465            16.72105            .03596

F =       2.79321       Signif F =  .0953

---------------------- Variables in the Equation -----------------

Variable              B        SE B       Beta          T  Sig T

PRCCOMPT       -.013263     .007936   -.077273     -1.671  .0953
(Constant)      .140499     .037464                3.750  .0002


End Block Number   1   All requested variables entered.

* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     New Zealand Data

Equation Number 1    Dependent Variable..   PRODSPMG   Margin Productivity of Sp

Block Number  1.  Method:  Enter      PRCCOMPT


Variable(s) Entered on Step Number
   1..    PRCCOMPT  Price based Competition - IC06,07,08,12


Multiple R            .09293
R Square              .00864
Adjusted R Square     .00652
Standard Error        .19051

Analysis of Variance
                 DF        Sum of Squares      Mean Square
Regression        1              .14827            .14827
Residual        469            17.02180            .03629

F =       4.08527       Signif F =  .0438

---------------------- Variables in the Equation -----------------

Variable              B        SE B       Beta          T  Sig T

PRCCOMPT       -.016207     .008018   -.092927     -2.021  .0438
(Constant)      .159852     .037859                4.222  .0000


End Block Number   1   All requested variables entered.
```

**** MULTIPLE REGRESSION ****

Listwise Deletion of Missing Data **Chain 1 Data**

Equation Number 1 Dependent Variable.. PRSALABR Sales Productivity of Lab

Block Number 1. Method: Enter SRVCOMPT

Variable(s) Entered on Step Number
1.. SRVCOMPT Service Based Competition Scale = (ia07

Multiple R	.09401
R Square	.00884
Adjusted R Square	-.00641
Standard Error	.08311

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.00400	.00400
Residual	65	.44902	.00691

F = .57959 Signif F = .4492

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
SRVCOMPT	.006655	.008741	.094011	.761	.4492
(Constant)	.213212	.045930		4.642	.0000

End Block Number 1 All requested variables entered.

**** MULTIPLE REGRESSION ****

Listwise Deletion of Missing Data **Chain 1 Data**

Equation Number 1 Dependent Variable.. PRMGLABR Margin Productivity of la

Block Number 1. Method: Enter SRVCOMPT

Variable(s) Entered on Step Number
1.. SRVCOMPT Service Based Competition Scale = (ia07

Multiple R	.02398
R Square	.00058
Adjusted R Square	-.01480
Standard Error	.21199

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.00168	.00168
Residual	65	2.92103	.04494

F = .03741 Signif F = .8472

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
SRVCOMPT	-.004312	.022295	-.023985	-.193	.8472
(Constant)	.313234	.117147		2.674	.0095

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **Chain 1 Data**

Equation Number 1 Dependent Variable.. PRSACAPT Sales Productivity of Cap

Block Number 1. Method: Enter SRVCOMPT

Variable(s) Entered on Step Number
1.. SRVCOMPT Service Based Competition Scale = (1a07

Multiple R	.03523
R Square	.00124
Adjusted R Square	-.01436
Standard Error	.26499

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.00558	.00558
Residual	64	4.49405	.07022

F = .07952 Signif F = .7789

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
SRVCOMPT	.007893	.027990	.035228	.282	.7789
(Constant)	.969338	.146732		6.606	.0000

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **Chain 1 Data**

Equation Number 1 Dependent Variable.. PRMGCAPT Margin Productivity of Ca

Block Number 1. Method: Enter SRVCOMPT

Variable(s) Entered on Step Number
1.. SRVCOMPT Service Based Competition Scale = (1a07

Multiple R	.05048
R Square	.00255
Adjusted R Square	-.01304
Standard Error	.49247

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.03965	.03965
Residual	64	15.52174	.24253

F = .16350 Signif F = .6873

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
SRVCOMPT	-.021033	.052018	-.050479	-.404	.6873
(Constant)	1.248828	.272693		4.580	.0000

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **Chain 1 Data**

Equation Number 1 Dependent Variable.. PRSASPAC Sales Productivity of Spa

Block Number 1. Method: Enter SRVCOMPT

Variable(s) Entered on Step Number
1.. SRVCOMPT Service Based Competition Scale = (ia07

Multiple R	.17073
R Square	.02915
Adjusted R Square	.01398
Standard Error	2.52340E-04

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.00000	.00000
Residual	64	.00000	.00000

F = 1.92158 Signif F = .1705

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
SRVCOMPT	3.69184E-05	2.6633E-05	.170732	1.386	.1705
(Constant)	4.74787E-04	1.4028E-04		3.385	.0012

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **Chain 1 Data**

Equation Number 1 Dependent Variable.. PRMGSPAC Margin Productivity of Sp

Block Number 1. Method: Enter SRVCOMPT

Variable(s) Entered on Step Number
1.. SRVCOMPT Service Based Competition Scale = (ia07

Multiple R	.02713
R Square	.00074
Adjusted R Square	-.01488
Standard Error	4.40889E-04

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.00000	.00000
Residual	64	.00001	.00000

F = .04713 Signif F = .8288

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
SRVCOMPT	1.01022E-05	4.6533E-05	.027127	.217	.8288
(Constant)	6.98894E-04	2.4509E-04		2.852	.0059

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **Chain 1 Data**

Equation Number 1 Dependent Variable.. PRSALABR Sales Productivity of Lab

Block Number 1. Method: Enter PRCCOMPT

Variable(s) Entered on Step Number
1.. PRCCOMPT Price Based Competition Scale = (ia03 +

Multiple R	.10584
R Square	.01120
Adjusted R Square	-.00401
Standard Error	.08368

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.00516	.00516
Residual	65	.45513	.00700

F = .73645 Signif F = .3940

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
PRCCOMPT	-.010402	.012121	-.105845	-.858	.3940
(Constant)	.304302	.066103		4.603	.0000

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **Chain 1 Data**

Equation Number 1 Dependent Variable.. PRMGLABR Margin Productivity of la

Block Number 1. Method: Enter PRCCOMPT

Variable(s) Entered on Step Number
1.. PRCCOMPT Price Based Competition Scale = (ia03 +

Multiple R	.15610
R Square	.02437
Adjusted R Square	.00936
Standard Error	.21001

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.07160	.07160
Residual	65	2.86683	.04411

F = 1.62340 Signif F = .2072

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
PRCCOMPT	-.038760	.030420	-.156099	-1.274	.2072
(Constant)	.502331	.165903		3.028	.0035

End Block Number 1 All requested variables entered.

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 1 Data

Equation Number 1    Dependent Variable..   PRSACAPT   Sales Productivity of Cap

Block Number  1.  Method:  Enter      PRCCOMPT


Variable(s) Entered on Step Number
   1..    PRCCOMPT  Price Based Competition Scale = (ia03 +


Multiple R            .18061
R Square              .03262
Adjusted R Square     .01750
Standard Error        .26057

Analysis of Variance
                    DF        Sum of Squares      Mean Square
Regression           1              .14653            .14653
Residual            64             4.34546            .06790

F =       2.15807       Signif F =  .1467

------------------ Variables in the Equation ------------------

Variable              B         SE B        Beta          T  Sig T

PRCCOMPT        -.055459      .037752   -.180610    -1.469  .1467
(Constant)     1.303079      .206000                6.326  .0000


End Block Number   1   All requested variables entered.


* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 1 Data

Equation Number 1    Dependent Variable..   PRMGCAPT   Margin Productivity of Ca

Block Number  1.  Method:  Enter      PRCCOMPT


Variable(s) Entered on Step Number
   1..    PRCCOMPT  Price Based Competition Scale = (ia03 +


Multiple R            .18371
R Square              .03375
Adjusted R Square     .01865
Standard Error        .48485

Analysis of Variance
                    DF        Sum of Squares      Mean Square
Regression           1              .52549            .52549
Residual            64            15.04513            .23508

F =       2.23536       Signif F =  .1398

------------------ Variables in the Equation ------------------

Variable              B         SE B        Beta          T  Sig T

PRCCOMPT        -.105024      .070245   -.183708    -1.495  .1398
(Constant)     1.705749      .383307                4.450  .0000


End Block Number   1   All requested variables entered.
```

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 1 Data

Equation Number 1    Dependent Variable..   PRSASPAC   Sales Productivity of Spa

Block Number  1.  Method:  Enter      PRCCOMPT


Variable(s) Entered on Step Number
   1..    PRCCOMPT  Price Based Competition Scale = (ia03 +


Multiple R            .10017
R Square              .01003
Adjusted R Square    -.00520
Standard Error  2.52997E-04

Analysis of Variance
                    DF        Sum of Squares        Mean Square
Regression           1               .00000               .00000
Residual            65               .00000               .00000

F =         .65887       Signif F =  .4199


------------------ Variables in the Equation ------------------

Variable              B         SE B        Beta          T  Sig T

PRCCOMPT    -2.97464E-05  3.6647E-05    -.100173      -.812  .4199
(Constant)   8.23617E-04  1.9986E-04                 4.121  .0001


End Block Number   1   All requested variables entered.


* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 1 Data

Equation Number 1    Dependent Variable..   PRMGSPAC   Margin Productivity of Sp

Block Number  1.  Method:  Enter      PRCCOMPT


Variable(s) Entered on Step Number
   1..    PRCCOMPT  Price Based Competition Scale = (ia03 +


Multiple R            .14065
R Square              .01978
Adjusted R Square     .00470
Standard Error  4.33297E-04

Analysis of Variance
                    DF        Sum of Squares        Mean Square
Regression           1               .00000               .00000
Residual            65               .00001               .00000

F =        1.31184       Signif F =  .2563


------------------ Variables in the Equation ------------------

Variable              B         SE B        Beta          T  Sig T

PRCCOMPT    -7.18865E-05  6.2763E-05    -.140652     -1.145  .2563
(Constant)       .001138  3.4229E-04                 3.325  .0015


End Block Number   1   All requested variables entered.
```

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 2 Data

Equation Number 1    Dependent Variable..   PRSALABR   Sales Productivity of Lab

Block Number  1.  Method:  Enter      SRVCOMPT


Variable(s) Entered on Step Number
   1..    SRVCOMPT  Service Based Competition = (ic09 + ic10


Multiple R            .06226
R Square              .00388
Adjusted R Square    -.01273
Standard Error        .30102

Analysis of Variance
                 DF       Sum of Squares       Mean Square
Regression        1                .02116            .02116
Residual         60              5.43690            .09061

F =        .23351       Signif F =  .6307


---------------- Variables in the Equation -----------------

Variable              B         SE B       Beta          T  Sig T

SRVCOMPT        .012124      .025090    .062264       .483  .6307
(Constant)      .914430      .143064                 6.392  .0000


End Block Number   1   All requested variables entered.


* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 2 Data

Equation Number 1    Dependent Variable..   PRMGLABR   Margin Productivity of La

Block Number  1.  Method:  Enter      SRVCOMPT


Variable(s) Entered on Step Number
   1..    SRVCOMPT  Service Based Competition = (ic09 + ic10


Multiple R            .07273
R Square              .00529
Adjusted R Square    -.01102
Standard Error        .33802

Analysis of Variance
                 DF       Sum of Squares       Mean Square
Regression        1                .03707            .03707
Residual         61              6.96971            .11426

F =        .32442       Signif F =  .5711


---------------- Variables in the Equation -----------------

Variable              B         SE B       Beta          T  Sig T

SRVCOMPT        .015156      .026609    .072733       .570  .5711
(Constant)      .927179      .149922                 6.184  .0000


End Block Number   1   All requested variables entered.
```

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 2 Data

Equation Number 1    Dependent Variable..   PRSACAPT   Sales Productivity of Cap

Block Number  1.  Method:  Enter      SRVCOMPT


Variable(s) Entered on Step Number
   1..     SRVCOMPT  Service Based Competition = (ic09 + ic10


Multiple R            .16515
R Square              .02727
Adjusted R Square     .01050
Standard Error        .24765

Analysis of Variance
                    DF        Sum of Squares      Mean Square
Regression           1              .09974             .09974
Residual            58             3.55725             .06133

F =        1.62621       Signif F =  .2073


------------------ Variables in the Equation ------------------

Variable              B         SE B       Beta          T  Sig T

SRVCOMPT         .026410      .020710     .165146      1.275  .2073
(Constant)       .920824      .118087                  7.798  .0000


End Block Number   1   All requested variables entered.


* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 2 Data

Equation Number 1    Dependent Variable..   PRMGCAPT   Margin Productivity of Ca

Block Number  1.  Method:  Enter      SRVCOMPT


Variable(s) Entered on Step Number
   1..     SRVCOMPT  Service Based Competition = (ic09 + ic10


Multiple R            .24858
R Square              .06179
Adjusted R Square     .04562
Standard Error        .19690

Analysis of Variance
                    DF        Sum of Squares      Mean Square
Regression           1              .14809             .14809
Residual            58             2.24854             .03877

F =        3.81999       Signif F =  .0555


------------------ Variables in the Equation ------------------

Variable              B         SE B       Beta          T  Sig T

SRVCOMPT         .032442      .016599     .248580      1.954  .0555
(Constant)       .878531      .094232                  9.323  .0000


End Block Number   1   All requested variables entered.
```

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 2 Data

Equation Number 1    Dependent Variable..   PRSASPAC   Sales Productivity of Spa

Block Number  1.  Method:  Enter      SRVCOMPT


Variable(s) Entered on Step Number
   1..    SRVCOMPT  Service Based Competition = (ic09 + ic10


Multiple R            .04345
R Square              .00189
Adjusted R Square    -.01532
Standard Error  1.68255E-03

Analysis of Variance
                    DF       Sum of Squares       Mean Square
Regression           1              .00000              .00000
Residual            58              .00016              .00000

F =         .10969       Signif F =  .7417


------------------ Variables in the Equation ------------------

Variable              B         SE B        Beta          T  Sig T

SRVCOMPT    4.67962E-05  1.4130E-04     .043446       .331  .7417
(Constant)      .005305  8.0163E-04                  6.618  .0000


End Block Number   1   All requested variables entered.


* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 2 Data

Equation Number 1    Dependent Variable..   PRMGSPAC   Margin Productivity of Sp

Block Number  1.  Method:  Enter      SRVCOMPT


Variable(s) Entered on Step Number
   1..    SRVCOMPT  Service Based Competition = (ic09 + ic10


Multiple R            .10951
R Square              .01199
Adjusted R Square    -.00475
Standard Error  1.51258E-03

Analysis of Variance
                    DF       Sum of Squares       Mean Square
Regression           1              .00000              .00000
Residual            59              .00013              .00000

F =         .71614       Signif F =  .4008


------------------ Variables in the Equation ------------------

Variable              B         SE B        Beta          T  Sig T

SRVCOMPT    1.01569E-04  1.2002E-04     .109510       .846  .4008
(Constant)      .004900  6.7254E-04                  7.285  .0000


End Block Number   1   All requested variables entered.
```

**** MULTIPLE REGRESSION ****

Listwise Deletion of Missing Data **Chain 2 Data**

Equation Number 1 Dependent Variable.. PRSALABR Sales Productivity of Lab

Block Number 1. Method: Enter PRCCOMPT

Variable(s) Entered on Step Number
1.. PRCCOMPT Price Based Competition = (ic06 + ic07 +

Multiple R .15955
R Square .02546
Adjusted R Square .00836
Standard Error .29366

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.12840	.12840
Residual	57	4.91542	.08624

F = 1.48895 Signif F = .2274

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
PRCCOMPT	-.039541	.032404	-.159552	-1.220	.2274
(Constant)	1.159718	.142927		8.114	.0000

End Block Number 1 All requested variables entered.

**** MULTIPLE REGRESSION ****

Listwise Deletion of Missing Data **Chain 2 Data**

Equation Number 1 Dependent Variable.. PRMGLABR Margin Productivity of La

Block Number 1. Method: Enter PRCCOMPT

Variable(s) Entered on Step Number
1.. PRCCOMPT Price Based Competition = (ic06 + ic07 +

Multiple R .01070
R Square .00011
Adjusted R Square -.01743
Standard Error .33914

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.00075	.00075
Residual	57	6.55592	.11502

F = .00653 Signif F = .9359

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
PRCCOMPT	-.003016	.037336	-.010699	-.081	.9359
(Constant)	1.032887	.163638		6.312	.0000

End Block Number 1 All requested variables entered.

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 2 Data

Equation Number 1    Dependent Variable..   PRSACAPT   Sales Productivity of Cap

Block Number  1.  Method:  Enter      PRCCOMPT


Variable(s) Entered on Step Number
   1..    PRCCOMPT  Price Based Competition = (ic06 + ic07 +


Multiple R            .06523
R Square              .00426
Adjusted R Square    -.01385
Standard Error        .25625

Analysis of Variance
                    DF        Sum of Squares      Mean Square
Regression           1              .01543            .01543
Residual            55             3.61148            .06566

F =         .23505       Signif F =  .6297


------------------ Variables in the Equation ------------------

Variable               B         SE B        Beta           T  Sig T

PRCCOMPT        -.014050      .028981    -.065233      -.485  .6297
(Constant)     1.124565      .126413                  8.896  .0000


End Block Number   1   All requested variables entered.


          * * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 2 Data

Equation Number 1    Dependent Variable..   PRMGCAPT   Margin Productivity of Ca

Block Number  1.  Method:  Enter      PRCCOMPT


Variable(s) Entered on Step Number
   1..    PRCCOMPT  Price Based Competition = (ic06 + ic07 +


Multiple R            .01804
R Square              .00033
Adjusted R Square    -.01785
Standard Error        .20819

Analysis of Variance
                    DF        Sum of Squares      Mean Square
Regression           1              .00078            .00078
Residual            55            2.38390            .04334

F =         .01791       Signif F =  .8940


------------------ Variables in the Equation ------------------

Variable               B         SE B        Beta           T  Sig T

PRCCOMPT         .003147      .023514    .018042       .134  .8940
(Constant)     1.043391      .101879                 10.241  .0000
End Block Number   1   All requested variables entered.
```

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 2 Data

Equation Number 1    Dependent Variable..   PRSASPAC   Sales Productivity of Spa

Block Number  1.  Method:  Enter      PRCCOMPT


Variable(s) Entered on Step Number
   1..    PRCCOMPT  Price Based Competition = (ic06 + ic07 +


Multiple R            .21887
R Square              .04790
Adjusted R Square     .03059
Standard Error  1.68370E-03

Analysis of Variance
                    DF        Sum of Squares        Mean Square
Regression           1               .00001              .00001
Residual            55               .00016              .00000

F =       2.76727       Signif F =  .1019


------------------ Variables in the Equation ------------------

Variable              B         SE B        Beta          T  Sig T

PRCCOMPT     3.12247E-04  1.8770E-04     .218869      1.664  .1019
(Constant)       .004256  8.2357E-04                  5.168  .0000


End Block Number   1   All requested variables entered.
```

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 2 Data

Equation Number 1    Dependent Variable..   PRMGSPAC   Margin Productivity of Sp

Block Number  1.  Method:  Enter      PRCCOMPT


Variable(s) Entered on Step Number
   1..    PRCCOMPT  Price Based Competition = (ic06 + ic07 +


Multiple R            .27546
R Square              .07588
Adjusted R Square     .05908
Standard Error  1.50096E-03

Analysis of Variance
                    DF        Sum of Squares        Mean Square
Regression           1               .00001              .00001
Residual            55               .00012              .00000

F =       4.51611       Signif F =  .0381


------------------ Variables in the Equation ------------------

Variable              B         SE B        Beta          T  Sig T

PRCCOMPT     3.54957E-04  1.6703E-04     .275464      2.125  .0381
(Constant)       .003995  7.2802E-04                  5.487  .0000


End Block Number   1   All requested variables entered.
```

Regression Results - Hypothesis 4

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     New Zealand Data

Equation Number 1    Dependent Variable..   PRODLBSA   Sales Productivity of Lab

Block Number  1.  Method:  Enter      IIA6A


Variable(s) Entered on Step Number
   1..    IIA6A     Wages Paid to Employees


Multiple R            .48743
R Square              .23759
Adjusted R Square     .23533
Standard Error        .47840

Analysis of Variance
                    DF        Sum of Squares        Mean Square
Regression           1             24.10591           24.10591
Residual           338             77.35578             .22886

F =     105.32890        Signif F =  .0000

------------------ Variables in the Equation ------------------

Variable               B         SE B        Beta           T  Sig T

IIA6A       -1.54028E-04  1.5008E-05   -.487428    -10.263  .0000
(Constant)     1.593822     .036243                 43.976  .0000


End Block Number   1   All requested variables entered.


* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     New Zealand Data

Equation Number 1    Dependent Variable..   PRODLBMG   Margin Productivity of La

Block Number  1.  Method:  Enter      IIA6A


Variable(s) Entered on Step Number
   1..    IIA6A     Wages Paid to Employees


Multiple R            .50517
R Square              .25519
Adjusted R Square     .25298
Standard Error        .60246

Analysis of Variance
                    DF        Sum of Squares        Mean Square
Regression           1             41.78440           41.78440
Residual           336            121.95223             .36295

F =     115.12343        Signif F =  .0000

------------------ Variables in the Equation ------------------

Variable               B         SE B        Beta           T  Sig T

IIA6A       -2.06064E-04  1.9205E-05   -.505166    -10.730  .0000
(Constant)     1.793967     .046126                 38.892  .0000
End Block Number   1   All requested variables entered.
```

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **New Zealand Data**

Equation Number 1 Dependent Variable.. PRODCPSA Sales Productivity of Cap

Block Number 1. Method: Enter IIA6A

Variable(s) Entered on Step Number
1.. IIA6A Wages Paid to Employees

Multiple R	.09512
R Square	.00905
Adjusted R Square	.00686
Standard Error	.22403

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.20713	.20713
Residual	452	22.68463	.05019

F = 4.12716 Signif F = .0428

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
IIA6A	1.35168E-05	6.6535E-06	.095122	2.032	.0428
(Constant)	.990322	.014601		67.827	.0000

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **New Zealand Data**

Equation Number 1 Dependent Variable.. PRODCPMG Margin Productivity of Ca

Block Number 1. Method: Enter IIA6A

Variable(s) Entered on Step Number
1.. IIA6A Wages Paid to Employees

Multiple R	.13467
R Square	.01814
Adjusted R Square	.01594
Standard Error	.40622

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	1.35950	1.35950
Residual	446	73.59732	.16502

F = 8.23858 Signif F = .0043

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
IIA6A	-3.51498E-05	1.2246E-05	-.134674	-2.870	.0043
(Constant)	1.173442	.026780		43.818	.0000

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **New Zealand Data**

Equation Number 1 Dependent Variable.. PRODSPSA Sales Productivity of Spa

Block Number 1. Method: Enter IIA6A

Variable(s) Entered on Step Number
1.. IIA6A Wages Paid to Employees

Multiple R	.32368
R Square	.10477
Adjusted R Square	.10265
Standard Error	.06186

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.18988	.18988
Residual	424	1.62257	.00383

F = 49.61923 Signif F = .0000

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
IIA6A	1.30390E-05	1.8511E-06	.323676	7.044	.0000
(Constant)	.046852	.004123		11.364	.0000

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **New Zealand Data**

Equation Number 1 Dependent Variable.. PRODSPMG Margin Productivity of Sp

Block Number 1. Method: Enter IIA6A

Variable(s) Entered on Step Number
1.. IIA6A Wages Paid to Employees

Multiple R	.18176
R Square	.03304
Adjusted R Square	.03078
Standard Error	.07672

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.08606	.08606
Residual	428	2.51894	.00589

F = 14.62285 Signif F = .0002

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
IIA6A	8.88544E-06	2.3236E-06	.181760	3.824	.0002
(Constant)	.058766	.005123		11.471	.0000

End Block Number 1 All requested variables entered.

```
* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 1 Data

Equation Number 1    Dependent Variable..   PRSALABR   Sales Productivity of Lab

Block Number  1.  Method:  Enter      GENERAL2


Variable(s) Entered on Step Number
   1..    GENERAL2  General Wages


Multiple R            .07494
R Square              .00562
Adjusted R Square    -.00923
Standard Error        .08305

Analysis of Variance
                    DF        Sum of Squares        Mean Square
Regression           1               .00261               .00261
Residual            67               .46214               .00690

F =         .37840       Signif F =  .5405

------------------ Variables in the Equation ------------------

Variable                B         SE B        Beta           T  Sig T

GENERAL2          .007936      .012901     .074940        .615  .5405
(Constant)        .171032      .125079                   1.367  .1761


End Block Number   1   All requested variables entered.

* * * *  M U L T I P L E   R E G R E S S I O N  * * * *

Listwise Deletion of Missing Data     Chain 1 Data

Equation Number 1    Dependent Variable..   PRMGLABR   Margin Productivity of la

Block Number  1.  Method:  Enter      GENERAL2


Variable(s) Entered on Step Number
   1..    GENERAL2  General Wages


Multiple R            .05535
R Square              .00306
Adjusted R Square    -.01182
Standard Error        .20956

Analysis of Variance
                    DF        Sum of Squares        Mean Square
Regression           1               .00904               .00904
Residual            67              2.94231               .04392

F =         .20589       Signif F =  .6515

------------------ Variables in the Equation ------------------

Variable                B         SE B        Beta           T  Sig T

GENERAL2          .014770      .032551     .055350        .454  .6515
(Constant)        .148699      .315602                    .471  .6391


End Block Number   1   All requested variables entered.
```

**** MULTIPLE REGRESSION ****

Listwise Deletion of Missing Data **Chain 1 Data**

Equation Number 1 Dependent Variable.. PRSACAPT Sales Productivity of Cap

Block Number 1. Method: Enter GENERAL2

Variable(s) Entered on Step Number
1.. GENERAL2 General Wages

Multiple R	.24785
R Square	.06143
Adjusted R Square	.04721
Standard Error	.25381

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.27826	.27826
Residual	66	4.25165	.06442

F = 4.31953 Signif F = .0416

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
GENERAL2	.083168	.040016	.247845	2.078	.0416
(Constant)	.204448	.387323		.528	.5994

End Block Number 1 All requested variables entered.

**** MULTIPLE REGRESSION ****

Listwise Deletion of Missing Data **Chain 1 Data**

Equation Number 1 Dependent Variable.. PRMGCAPT Margin Productivity of Ca

Block Number 1. Method: Enter GENERAL2

Variable(s) Entered on Step Number
1.. GENERAL2 General Wages

Multiple R	.15370
R Square	.02362
Adjusted R Square	.00883
Standard Error	.48036

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.36847	.36847
Residual	66	15.22893	.23074

F = 1.59691 Signif F = .2108

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
GENERAL2	.095705	.075734	.153701	1.264	.2108
(Constant)	.214038	.733043		.292	.7712

End Block Number 1 All requested variables entered.

**** MULTIPLE REGRESSION ****

Listwise Deletion of Missing Data **Chain 1 Data**

Equation Number 1 Dependent Variable.. PRSASPAC Sales Productivity of Spa

Block Number 1. Method: Enter GENERAL2

Variable(s) Entered on Step Number
1.. GENERAL2 General Wages

Multiple R .22729
R Square .05166
Adjusted R Square .03729
Standard Error 2.45765E-04

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.00000	.00000
Residual	66	.00000	.00000

F = 3.59539 Signif F = .0623

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
GENERAL2	7.27444E-05	3.8364E-05	.227291	1.896	.0623
(Constant)	-3.99371E-05	3.7233E-04		-.107	.9149

End Block Number 1 All requested variables entered.

**** MULTIPLE REGRESSION ****

Listwise Deletion of Missing Data **Chain 1 Data**

Equation Number 1 Dependent Variable.. PRMGSPAC Margin Productivity of Sp

Block Number 1. Method: Enter GENERAL2

Variable(s) Entered on Step Number
1.. GENERAL2 General Wages

Multiple R .14207
R Square .02019
Adjusted R Square .00534
Standard Error 4.29998E-04

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.00000	.00000
Residual	66	.00001	.00000

F = 1.35967 Signif F = .2478

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
GENERAL2	7.82691E-05	6.7123E-05	.142075	1.166	.2478
(Constant)	-7.57465E-06	6.5144E-04		-.012	.9908

End Block Number 1 All requested variables entered.

**** MULTIPLE REGRESSION ****

Listwise Deletion of Missing Data **Chain 2 Data**

Equation Number 1 Dependent Variable.. PRSALABR Sales Productivity of Lab

Block Number 1. Method: Enter IIA5A

Variable(s) Entered on Step Number
1.. IIA5A Wages Paid to Employees

Multiple R	.02312
R Square	.00053
Adjusted R Square	-.01585
Standard Error	.29963

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.00293	.00293
Residual	61	5.47660	.08978

F = .03263 Signif F = .8572

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
IIA5A	.001587	.008785	.023123	.181	.8572
(Constant)	.964886	.085308		11.311	.0000

End Block Number 1 All requested variables entered.

**** MULTIPLE REGRESSION ****

Listwise Deletion of Missing Data **Chain 2 Data**

Equation Number 1 Dependent Variable.. PRMGLABR Margin Productivity of La

Block Number 1. Method: Enter IIA5A

Variable(s) Entered on Step Number
1.. IIA5A Wages Paid to Employees

Multiple R	.02827
R Square	.00080
Adjusted R Square	-.01532
Standard Error	.33652

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.00562	.00562
Residual	62	7.02112	.11324

F = .04959 Signif F = .8245

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
IIA5A	.002128	.009557	.028271	.223	.8245
(Constant)	.988012	.094389		10.467	.0000

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **Chain 2 Data**

Equation Number 1 Dependent Variable.. PRSACAPT Sales Productivity of Cap

Block Number 1. Method: Enter IIA5A

Variable(s) Entered on Step Number
1.. IIA5A Wages Paid to Employees

Multiple R	.07336
R Square	.00538
Adjusted R Square	-.01148
Standard Error	.24840

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.01969	.01969
Residual	59	3.64035	.06170

F = .31920 Signif F = .5742

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
IIA5A	.006537	.011571	.073355	.565	.5742
(Constant)	1.010687	.101046		10.002	.0000

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **Chain 2 Data**

Equation Number 1 Dependent Variable.. PRMGCAPT Margin Productivity of Ca

Block Number 1. Method: Enter IIA5A

Variable(s) Entered on Step Number
1.. IIA5A Wages Paid to Employees

Multiple R	.07249
R Square	.00525
Adjusted R Square	-.01161
Standard Error	.20102

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.01259	.01259
Residual	59	2.38407	.04041

F = .31168 Signif F = .5788

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
IIA5A	.004811	.008618	.072491	.558	.5788
(Constant)	1.015163	.077189		13.152	.0000

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **Chain 2 Data**

Equation Number 1 Dependent Variable.. PRSASPAC Sales Productivity of Spa

Block Number 1. Method: Enter IIA5A

Variable(s) Entered on Step Number
1.. IIA5A Wages Paid to Employees

Multiple R .19502
R Square .03803
Adjusted R Square .02173
Standard Error 1.63849E-03

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.00001	.00001
Residual	59	.00016	.00000

F = 2.33275 Signif F = .1320

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
IIA5A	7.33961E-05	4.8055E-05	.195024	1.527	.1320
(Constant)	.004929	4.6731E-04		10.548	.0000

End Block Number 1 All requested variables entered.

* * * * M U L T I P L E R E G R E S S I O N * * * *

Listwise Deletion of Missing Data **Chain 2 Data**

Equation Number 1 Dependent Variable.. PRMGSPAC Margin Productivity of Sp

Block Number 1. Method: Enter IIA5A

Variable(s) Entered on Step Number
1.. IIA5A Wages Paid to Employees

Multiple R .22609
R Square .05112
Adjusted R Square .03530
Standard Error 1.47286E-03

Analysis of Variance

	DF	Sum of Squares	Mean Square
Regression	1	.00001	.00001
Residual	60	.00013	.00000

F = 3.23235 Signif F = .0772

---------- Variables in the Equation ----------

Variable	B	SE B	Beta	T	Sig T
IIA5A	7.52170E-05	4.1837E-05	.226094	1.798	.0772
(Constant)	.004793	4.1398E-04		11.577	.0000

End Block Number 1 All requested variables entered.

Appendix V LISREL Results

Measurement Model Results

Goodness of Fit Indicators for Measurement Model

CHI-SQUARE WITH 80 DEGREES OF FREEDOM = 326.84 (P = 0.0)
CHI-SQUARE DIFFERENCE WITH 1 DEGREE OF FREEDOM = 5.49 (P = 0.019)
ESTIMATED NON-CENTRALITY PARAMETER (NCP) = 246.84
MINIMUM FIT FUNCTION VALUE = 0.94
POPULATION DISCREPANCY FUNCTION VALUE (F0) = 0.71
ROOT MEAN SQUARE ERROR OF APPROXIMATION (RMSEA) = 0.094
P-VALUE FOR TEST OF CLOSE FIT (RMSEA < 0.05) = 0.00000034
EXPECTED CROSS-VALIDATION INDEX (ECVI) = 1.18
ECVI FOR SATURATED MODEL = 0.69
ECVI FOR INDEPENDENCE MODEL = 10.72
CHI-SQUARE FOR INDEPENDENCE MODEL WITH 105 DEGREES OF FREEDOM = 3680.06
INDEPENDENCE AIC = 3710.06
MODEL AIC = 406.84
SATURATED AIC = 240.00
INDEPENDENCE CAIC = 3782.80
MODEL CAIC = 600.81
SATURATED CAIC = 821.92
ROOT MEAN SQUARE RESIDUAL (RMR) = 0.054
STANDARDIZED RMR = 0.054
GOODNESS OF FIT INDEX (GFI) = 0.89
ADJUSTED GOODNESS OF FIT INDEX (AGFI) = 0.84
PARSIMONY GOODNESS OF FIT INDEX (PGFI) = 0.59
NORMED FIT INDEX (NFI) = 0.91
NON-NORMED FIT INDEX (NNFI) = 0.91
PARSIMONY NORMED FIT INDEX (PNFI) = 0.69
COMPARATIVE FIT INDEX (CFI) = 0.93
INCREMENTAL FIT INDEX (IFI) = 0.93
RELATIVE FIT INDEX (RFI) = 0.88
CRITICAL N (CN) = 119.92

Output File for Measurement Model

```
DATE: 10/15/95
TIME: 10:36

WINDOWS  L I S R E L  8.10

BY

KARL G JORESKOG AND DAG SORBOM


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The following lines were read from file D:\EX\DATA\LISREL\DATA\KIWICH2.SPL:

Kiwi Retailing Model
Observed variables:

IIA1 IIA4B IIA7 IIA8 IIIA01 IIIA02 IIIA03 IIIA04 IIIA05
IIIA06 IIIA07 IIIA08 IIIB1 IV01 IV02 IV03 IV04 IV05 IV06
PRODLBSA PRODLBMG PRODSPSA PRODSPMG PRODCPSA PRODCPMG

Correlation matrix from file: D:\EX\data\lisrel\DATA\kiwicor2.txt

Sample Size: 347
Latent Variables:
SIZE CAPITAL SALES MARGIN PRODUCTY E

Paths
SALES  -> IV01 IV02 IV03  IV04
MARGIN -> IV04 IV05 IV06
!MARGIN -> IV01
SIZE  -> IIA1 IIA4B IIA7 IIA8
SIZE  -> IIIB1
CAPITAL -> IIIA02 IIIA07 IIIA08
CAPITAL -> IIIA01
!CAPITAL -> SALES
!SIZE  -> SALES
!SALES  -> MARGIN
!PRODUCTY -> SIZE CAPITAL
!PRODUCTY -> PRODLBMG  PRODSPMG PRODCPMG
!PRODUCTY -> PRODLBSA
!PRODUCTY -> PRODSPSA
!E -> PRODCPSA
!PRODUCTY -> SIZE
!PRODUCTY -> CAPITAL


!set the error covariance of PRODLBSA and PRODLBMG free
!set the error covariance of PRODLBSA and PRODSPSA free
set the error covariance of IIA1 AND IIA4B free
set the error covariance of IIIA01 AND IIIA02 free
!set the error covariance of IIIA07 AND IIIA08 free
set the error covariance of IV01 and IV04 free
set the error covariance of IV02 and IV05 free
!set the error covariance of IV03 and IV06 free
```

```
!set the error covariance of IV01 and PRODLBSA free
!set the error covariance of IV02 and PRODLBSA free
!set the error covariance of IV03 and PRODLBSA free
!set the error covariance of IV01 and PRODSPSA free
!set the error covariance of IV02 and PRODSPSA free
!set the error covariance of IV03 and PRODSPSA free
!set the error variance for CAPITAL = 0.19
!set the error variance for IV06 = 0

!relationships

!IIIA01 = 0.69*CAPITAL


Admissibility Check = 100
!Iterations = 100
Path Diagram
End of Problem

Sample Size =   347

Kiwi Retailing Model
```

CORRELATION MATRIX TO BE ANALYZED

	IIA1	IIA4B	IIA7	IIA8	IIIA01	IIIA02
IIA1	1.00					
IIA4B	0.60	1.00				
IIA7	0.42	0.29	1.00			
IIA8	0.65	0.40	0.45	1.00		
IIIA01	0.50	0.35	0.28	0.59	1.00	
IIIA02	0.48	0.29	0.26	0.57	0.76	1.00
IIIA07	0.54	0.30	0.32	0.64	0.59	0.58
IIIA08	0.51	0.28	0.27	0.62	0.56	0.54
IIIB1	0.25	0.20	0.16	0.22	0.25	0.28
IV01	0.59	0.35	0.36	0.67	0.55	0.51
IV02	0.56	0.33	0.27	0.54	0.47	0.47
IV03	0.68	0.41	0.40	0.68	0.57	0.54
IV04	0.46	0.21	0.28	0.55	0.47	0.36
IV05	0.31	0.16	0.14	0.30	0.26	0.20
IV06	0.35	0.16	0.21	0.39	0.31	0.22

CORRELATION MATRIX TO BE ANALYZED

	IIIA07	IIIA08	IIIB1	IV01	IV02	IV03
IIIA07	1.00					
IIIA08	0.77	1.00				
IIIB1	0.21	0.21	1.00			
IV01	0.66	0.81	0.21	1.00		
IV02	0.55	0.46	0.21	0.51	1.00	
IV03	0.71	0.65	0.25	0.71	0.76	1.00
IV04	0.48	0.60	0.12	0.73	0.38	0.54
IV05	0.23	0.19	0.08	0.20	0.50	0.41
IV06	0.33	0.28	0.11	0.35	0.50	0.52

CORRELATION MATRIX TO BE ANALYZED

	IV04	IV05	IV06
IV04	1.00		
IV05	0.30	1.00	
IV06	0.47	0.85	1.00

```
Kiwi Retailing Model
Number of Iterations = 22
```

LISREL ESTIMATES (MAXIMUM LIKELIHOOD)

IIA1 = 0.79*SIZE, Errorvar.= 0.38 , R^2 = 0.62
(0.047) (0.037)
16.73 10.19

IIA4B = 0.48*SIZE, Errorvar.= 0.77 , R^2 = 0.23
(0.054) (0.061)
8.87 12.53

IIA7 = 0.50*SIZE, Errorvar.= 0.75 , R^2 = 0.25
(0.053) (0.060)
9.38 12.59

IIA8 = 0.84*SIZE, Errorvar.= 0.29 , R^2 = 0.71
(0.046) (0.034)
18.42 8.45

IIIA01 = 0.69*CAPITAL, Errorvar.= 0.53 , R^2 = 0.47
(0.049) (0.044)
14.06 11.94

IIIA02 = 0.67*CAPITAL, Errorvar.= 0.56 , R^2 = 0.44
(0.049) (0.046)
13.50 12.06

IIIA07 = 0.88*CAPITAL, Errorvar.= 0.23 , R^2 = 0.77
(0.044) (0.027)
20.13 8.39

IIIA08 = 0.85*CAPITAL, Errorvar.= 0.27 , R^2 = 0.73
(0.044) (0.029)
19.24 9.40

IIIB1 = 0.29*SIZE, Errorvar.= 0.91 , R^2 = 0.086
(0.056) (0.070)
5.26 12.99

IV01 = 0.80*SALES, Errorvar.= 0.35 , R^2 = 0.65
(0.045) (0.031)
17.78 11.42

IV02 = 0.76*SALES, Errorvar.= 0.42 , R^2 = 0.58
(0.046) (0.035)
16.57 11.83

IV03 = 0.92*SALES, Errorvar.= 0.16 , R^2 = 0.84
(0.042) (0.021)
21.84 7.71

IV04 = 0.49*SALES + 0.25*MARGIN, Errorvar.= 0.60 , R^2 = 0.41
(0.053) (0.042) (0.047)
9.17 6.03 12.88

IV05 = 0.78*MARGIN, Errorvar.= 0.35 , R^2 = 0.64
(0.047) (0.040)
16.51 8.71

IV06 = 1.06*MARGIN, Errorvar.= -0.12 , R^2 = 1.12
(0.044) (0.056)
23.97 -2.17

W_A_R_N_I_N_G : Error variance is negative.

Error Covariance for IIA4B and IIA1 = 0.22
(0.037)
5.93

Error Covariance for IIIA02 and IIIA01 = 0.30
(0.037)
8.14

Error Covariance for IV04 and IV01 = 0.26
(0.031)
8.33
Error Covariance for IV05 and IV02 = 0.11
(0.020)
5.63

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	SIZE	CAPITAL	SALES	MARGIN
SIZE	1.00			
CAPITAL	0.84	1.00		
	(0.03)			
	29.93			
SALES	0.91	0.89	1.00	
	(0.02)	(0.02)		
	41.18	44.56		
MARGIN	0.41	0.34	0.52	1.00
	(0.05)	(0.05)	(0.04)	
	8.48	6.95	12.22	

GOODNESS OF FIT STATISTICS

CHI-SQUARE WITH 79 DEGREES OF FREEDOM = 321.35 (P = 0.0)
ESTIMATED NON-CENTRALITY PARAMETER (NCP) = 242.35

MINIMUM FIT FUNCTION VALUE = 0.93
POPULATION DISCREPANCY FUNCTION VALUE (F0) = 0.70
ROOT MEAN SQUARE ERROR OF APPROXIMATION (RMSEA) = 0.094
P-VALUE FOR TEST OF CLOSE FIT (RMSEA < 0.05) = 0.00000045

EXPECTED CROSS-VALIDATION INDEX (ECVI) = 1.17
ECVI FOR SATURATED MODEL = 0.69
ECVI FOR INDEPENDENCE MODEL = 10.72

CHI-SQUARE FOR INDEPENDENCE MODEL WITH 105 DEGREES OF FREEDOM = 3680.06
INDEPENDENCE AIC = 3710.06
MODEL AIC = 403.35
SATURATED AIC = 240.00
INDEPENDENCE CAIC = 3782.80
MODEL CAIC = 602.17
SATURATED CAIC = 821.92

ROOT MEAN SQUARE RESIDUAL (RMR) = 0.051
STANDARDIZED RMR = 0.051
GOODNESS OF FIT INDEX (GFI) = 0.89
ADJUSTED GOODNESS OF FIT INDEX (AGFI) = 0.84
PARSIMONY GOODNESS OF FIT INDEX (PGFI) = 0.59

NORMED FIT INDEX (NFI) = 0.91
NON-NORMED FIT INDEX (NNFI) = 0.91
PARSIMONY NORMED FIT INDEX (PNFI) = 0.69
COMPARATIVE FIT INDEX (CFI) = 0.93
INCREMENTAL FIT INDEX (IFI) = 0.93
RELATIVE FIT INDEX (RFI) = 0.88

CRITICAL N (CN) = 120.67

CONFIDENCE LIMITS COULD NOT BE COMPUTED DUE TO TOO SMALL P-VALUE FOR CHI-SQUARE

Kiwi Retailing Model

```
SUMMARY STATISTICS FOR FITTED RESIDUALS
SMALLEST FITTED RESIDUAL =    -0.12
  MEDIAN FITTED RESIDUAL =     0.00
 LARGEST FITTED RESIDUAL =     0.20

STEMLEAF PLOT
-12|51
-10|
- 8|74215
- 6|981
- 4|310066420
- 2|9826644332220
- 0|97554310085432210000000000000000
  0|11134557889002455666 78
  2|0113333566781459
  4|38115
  6|1338678
  8|067
 10|1503
 12|
 14|4
 16|
 18|
 20|4

SUMMARY STATISTICS FOR STANDARDIZED RESIDUALS
SMALLEST STANDARDIZED RESIDUAL =    -5.75
  MEDIAN STANDARDIZED RESIDUAL =     0.00
 LARGEST STANDARDIZED RESIDUAL =    11.17

STEMLEAF PLOT
- 5|82
- 4|33200
- 3|854
- 2|96221100
- 1|9988753211110
- 0|877665443333211110000000000000000000
  0|11222223444445677888999
  1|00122334455678899
  2|0125789
  3|222259
  4|2
  5|
  6|06
  7|
  8|
  9|
 10|
 11|2
LARGEST NEGATIVE STANDARDIZED RESIDUALS
RESIDUAL FOR    IIIA08 AND      IIA1   -2.62
RESIDUAL FOR    IIIA08 AND      IIA7   -2.89
RESIDUAL FOR      IV02 AND    IIIA08   -5.75
RESIDUAL FOR      IV02 AND      IV01   -5.23
RESIDUAL FOR      IV03 AND    IIIA08   -4.18
RESIDUAL FOR      IV03 AND      IV01   -3.77
RESIDUAL FOR      IV04 AND      IV01   -3.41
RESIDUAL FOR      IV04 AND      IV02   -3.55
RESIDUAL FOR      IV05 AND      IV01   -4.27
RESIDUAL FOR      IV05 AND      IV04   -4.32
RESIDUAL FOR      IV06 AND      IV01   -4.04
RESIDUAL FOR      IV06 AND      IV04   -4.02
LARGEST POSITIVE STANDARDIZED RESIDUALS
RESIDUAL FOR    IIIA01 AND      IIA8    4.21
RESIDUAL FOR    IIIA02 AND      IIA8    3.91
RESIDUAL FOR    IIIA08 AND    IIIA07    2.90
RESIDUAL FOR     IIIB1 AND    IIIA02    2.71
RESIDUAL FOR      IV01 AND      IIA8    3.15
RESIDUAL FOR      IV01 AND    IIIA08   11.17
RESIDUAL FOR      IV03 AND      IV02    6.64
```

```
RESIDUAL FOR      IV04 AND      IIA8    3.47
RESIDUAL FOR      IV04 AND    IIIA01    3.22
RESIDUAL FOR      IV04 AND    IIIA08    6.02
RESIDUAL FOR      IV05 AND      IV02    2.81
RESIDUAL FOR      IV06 AND      IV02    3.19
RESIDUAL FOR      IV06 AND      IV05    3.24

       THE MODIFICATION INDICES SUGGEST TO ADD THE
 PATH TO   FROM       DECREASE IN CHI-SQUARE    NEW ESTIMATE
IIA8       CAPITAL            12.5                 0.50
IV01       CAPITAL            41.1                 0.61
IV01       MARGIN             11.6                -0.14
IV02       SIZE                8.2                -0.41
IV02       CAPITAL            23.4                -0.55
IV02       MARGIN             10.1                 0.13
IV03       CAPITAL             9.0                -0.33

THE MODIFICATION INDICES SUGGEST TO ADD AN ERROR COVARIANCE
 BETWEEN     AND      DECREASE IN CHI-SQUARE    NEW ESTIMATE
IIIA08     IIIA07             8.4                 0.09
IV01       IIIA08            80.3                 0.15
IV02       IIIA08            24.7                -0.11
IV03       IIIA08            14.5                -0.07
IV03       IV02              56.4                 0.17
IV06       IV02               7.9                 0.09

         THE PROBLEM USED    30440 BYTES (=  1.7% OF AVAILABLE WORKSPACE)

                          TIME USED:     4.3 SECONDS


Kiwi Retailing Model
Number of Iterations =  9

LISREL ESTIMATES (MAXIMUM LIKELIHOOD)
The error variance for IV06 deleted

     IIA1 = 0.79*SIZE, Errorvar.= 0.38  , R² = 0.62
           (0.047)               (0.037)
            16.73                 10.19

    IIA4B = 0.48*SIZE, Errorvar.= 0.77  , R² = 0.23
           (0.054)               (0.061)
            8.85                  12.53

     IIA7 = 0.50*SIZE, Errorvar.= 0.75  , R² = 0.25
           (0.053)               (0.060)
            9.37                  12.59

     IIA8 = 0.84*SIZE, Errorvar.= 0.29  , R² = 0.71
           (0.046)               (0.034)
            18.43                 8.45

   IIIA01 = 0.69*CAPITAL, Errorvar.= 0.53  , R² = 0.47
           (0.049)                 (0.044)
            14.05                   11.94

   IIIA02 = 0.67*CAPITAL, Errorvar.= 0.56  , R² = 0.44
           (0.049)                 (0.046)
            13.50                   12.06

   IIIA07 = 0.88*CAPITAL, Errorvar.= 0.22  , R² = 0.78
           (0.044)                 (0.027)
            20.19                   8.28

   IIIA08 = 0.85*CAPITAL, Errorvar.= 0.27  , R² = 0.73
           (0.044)                 (0.029)
            19.17                   9.44
```

```
IIIB1 = 0.29*SIZE, Errorvar.= 0.91  , R² = 0.086
       (0.056)              (0.070)
        5.26                12.99

 IV01 = 0.80*SALES, Errorvar.= 0.36  , R² = 0.64
       (0.045)              (0.032)
        17.56               11.46

 IV02 = 0.78*SALES, Errorvar.= 0.41  , R² = 0.60
       (0.046)              (0.035)
        17.14               11.71

 IV03 = 0.92*SALES, Errorvar.= 0.15  , R² = 0.85
       (0.042)              (0.020)
        22.12               7.20

 IV04 = 0.46*SALES + 0.28*MARGIN, Errorvar.= 0.61  , R² = 0.42
       (0.053)      (0.043)                 (0.047)
        8.63         6.47                   12.78

 IV05 = 0.83*MARGIN, Errorvar.= 0.27  , R² = 0.72
       (0.042)              (0.021)
        19.95               13.15

 IV06 = 1.00*MARGIN,, R² = 1.00
       (0.038)
        26.31

Error Covariance for IIA4B and IIA1 = 0.22
                                     (0.037)
                                      5.94
Error Covariance for IIIA02 and IIIA01 = 0.30
                                        (0.037)
                                         8.13
Error Covariance for IV04 and IV01 = 0.27
                                    (0.032)
                                     8.42
Error Covariance for IV05 and IV02 = 0.11
                                    (0.020)
                                     5.42
```

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	SIZE	CAPITAL	SALES	MARGIN
SIZE	1.00			
CAPITAL	0.84	1.00		
	(0.03)			
	29.92			
SALES	0.90	0.88	1.00	
	(0.02)	(0.02)		
	40.73	43.31		
MARGIN	0.45	0.36	0.55	1.00
	(0.05)	(0.05)	(0.04)	
	9.29	7.22	13.57	

GOODNESS OF FIT STATISTICS

CHI-SQUARE WITH 80 DEGREES OF FREEDOM = 326.84 (P = 0.0)
CHI-SQUARE DIFFERENCE WITH 1 DEGREE OF FREEDOM = 5.49 (P = 0.019)
ESTIMATED NON-CENTRALITY PARAMETER (NCP) = 246.84

MINIMUM FIT FUNCTION VALUE = 0.94
POPULATION DISCREPANCY FUNCTION VALUE (F0) = 0.71

ROOT MEAN SQUARE ERROR OF APPROXIMATION (RMSEA) = 0.094
P-VALUE FOR TEST OF CLOSE FIT (RMSEA < 0.05) = 0.00000034

EXPECTED CROSS-VALIDATION INDEX (ECVI) = 1.18
ECVI FOR SATURATED MODEL = 0.69
ECVI FOR INDEPENDENCE MODEL = 10.72

CHI-SQUARE FOR INDEPENDENCE MODEL WITH 105 DEGREES OF FREEDOM = 3680.06
INDEPENDENCE AIC = 3710.06
MODEL AIC = 406.84
SATURATED AIC = 240.00
INDEPENDENCE CAIC = 3782.80
MODEL CAIC = 600.81
SATURATED CAIC = 821.92

ROOT MEAN SQUARE RESIDUAL (RMR) = 0.054
STANDARDIZED RMR = 0.054
GOODNESS OF FIT INDEX (GFI) = 0.89
ADJUSTED GOODNESS OF FIT INDEX (AGFI) = 0.84
PARSIMONY GOODNESS OF FIT INDEX (PGFI) = 0.59

NORMED FIT INDEX (NFI) = 0.91
NON-NORMED FIT INDEX (NNFI) = 0.91
PARSIMONY NORMED FIT INDEX (PNFI) = 0.69
COMPARATIVE FIT INDEX (CFI) = 0.93
INCREMENTAL FIT INDEX (IFI) = 0.93
RELATIVE FIT INDEX (RFI) = 0.88

CRITICAL N (CN) = 119.92

CONFIDENCE LIMITS COULD NOT BE COMPUTED DUE TO TOO SMALL P-VALUE FOR CHI-SQUARE

Kiwi Retailing Model

SUMMARY STATISTICS FOR FITTED RESIDUALS
SMALLEST FITTED RESIDUAL = -0.16
MEDIAN FITTED RESIDUAL = 0.00
LARGEST FITTED RESIDUAL = 0.22

STEMLEAF PLOT
-16|2
-14|
-12|92
-10|91
- 8|84
- 6|7150
- 4|5332188643
- 2|9667766554332111000
- 0|765431097544221000000000000000000
  0|235688999001244466
  2|013346012378
  4|233911
  6|0132578
  8|1
 10|1539
 12|
 14|
 16|5
 18|
 20|5

SUMMARY STATISTICS FOR STANDARDIZED RESIDUALS
SMALLEST STANDARDIZED RESIDUAL = -6.10
MEDIAN STANDARDIZED RESIDUAL = 0.00
LARGEST STANDARDIZED RESIDUAL = 11.34

STEMLEAF PLOT
- 6|1

```
- 51710
- 410
- 3199777
- 2|8765433300
- 1|9986433322100
- 0|98777666655553322111100000000000000000
  0|1122233444566678888
  1|0023333344556889
  2|111177999
  3|45669
  4|2
  5|
  6|3
  7|
  8|
  9|
 10|
 11|3
```

LARGEST NEGATIVE STANDARDIZED RESIDUALS

RESIDUAL FOR	IIIA08	AND	IIA7	-2.84
RESIDUAL FOR	IV02	AND	IIIA07	-2.72
RESIDUAL FOR	IV02	AND	IIIA08	-6.10
RESIDUAL FOR	IV02	AND	IV01	-5.71
RESIDUAL FOR	IV03	AND	IIIA08	-4.02
RESIDUAL FOR	IV03	AND	IV01	-3.92
RESIDUAL FOR	IV04	AND	IV01	-3.73
RESIDUAL FOR	IV04	AND	IV02	-3.89
RESIDUAL FOR	IV05	AND	IV01	-5.10
RESIDUAL FOR	IV05	AND	IV04	-4.95
RESIDUAL FOR	IV06	AND	IV01	-3.73
RESIDUAL FOR	IV06	AND	IV04	-3.73

LARGEST POSITIVE STANDARDIZED RESIDUALS

RESIDUAL FOR	IIIA01	AND	IIA8	4.22
RESIDUAL FOR	IIIA02	AND	IIA8	3.91
RESIDUAL FOR	IIIA08	AND	IIIA07	2.92
RESIDUAL FOR	IIIB1	AND	IIIA02	2.71
RESIDUAL FOR	IV01	AND	IIA8	3.51
RESIDUAL FOR	IV01	AND	IIIA01	2.72
RESIDUAL FOR	IV01	AND	IIIA08	11.34
RESIDUAL FOR	IV03	AND	IV02	3.65
RESIDUAL FOR	IV04	AND	IIA8	3.57
RESIDUAL FOR	IV04	AND	IIIA01	3.41
RESIDUAL FOR	IV04	AND	IIIA08	6.28
RESIDUAL FOR	IV06	AND	IV02	2.90
RESIDUAL FOR	IV06	AND	IV05	2.90

THE MODIFICATION INDICES SUGGEST TO ADD THE

PATH TO	FROM	DECREASE IN CHI-SQUARE	NEW ESTIMATE
IIA8	CAPITAL	12.2	0.49
IV01	CAPITAL	44.4	0.61
IV01	MARGIN	13.9	-0.17
IV02	SIZE	8.0	-0.40
IV02	CAPITAL	22.8	-0.52
IV02	MARGIN	8.4	0.13
IV03	CAPITAL	10.3	-0.35

THE MODIFICATION INDICES SUGGEST TO ADD AN ERROR COVARIANCE

BETWEEN	AND	DECREASE IN CHI-SQUARE	NEW ESTIMATE
IIIA08	IIIA07	8.5	0.09
IV01	IIIA08	79.0	0.15
IV02	IIIA08	23.7	-0.10
IV03	IIIA08	14.2	-0.07
IV03	IV02	55.2	0.17

THE PROBLEM USED 29576 BYTES (= 1.6% OF AVAILABLE WORKSPACE)

TIME USED: 3.0 SECONDS

Direct Model Results

Goodness Of Fit Indicators for Direct Model

CHI-SQUARE WITH 82 DEGREES OF FREEDOM = 341.09 (P = 0.0)
CHI-SQUARE DIFFERENCE WITH 1 DEGREE OF FREEDOM = 2.97 (P = 0.085)
ESTIMATED NON-CENTRALITY PARAMETER (NCP) = 259.09
MINIMUM FIT FUNCTION VALUE = 0.99
POPULATION DISCREPANCY FUNCTION VALUE (F0) = 0.75
ROOT MEAN SQUARE ERROR OF APPROXIMATION (RMSEA) = 0.096
P-VALUE FOR TEST OF CLOSE FIT (RMSEA < 0.05) = 0.00000040
EXPECTED CROSS-VALIDATION INDEX (ECVI) = 1.21
ECVI FOR SATURATED MODEL = 0.69
ECVI FOR INDEPENDENCE MODEL = 10.72
CHI-SQUARE FOR INDEPENDENCE MODEL WITH 105 DEGREES OF FREEDOM = 3680.06
INDEPENDENCE AIC = 3710.06
MODEL AIC = 417.09
SATURATED AIC = 240.00
INDEPENDENCE CAIC = 3782.80
MODEL CAIC = 601.37
SATURATED CAIC = 821.92
ROOT MEAN SQUARE RESIDUAL (RMR) = 0.057
STANDARDIZED RMR = 0.057
GOODNESS OF FIT INDEX (GFI) = 0.89
ADJUSTED GOODNESS OF FIT INDEX (AGFI) = 0.83
PARSIMONY GOODNESS OF FIT INDEX (PGFI) = 0.61
NORMED FIT INDEX (NFI) = 0.91
NON-NORMED FIT INDEX (NNFI) = 0.91
PARSIMONY NORMED FIT INDEX (PNFI) = 0.71
COMPARATIVE FIT INDEX (CFI) = 0.93
INCREMENTAL FIT INDEX (IFI) = 0.93
RELATIVE FIT INDEX (RFI) = 0.88
CRITICAL N (CN) = 117.35

Output File for Direct Model

DATE: 10/15/95
TIME: 10:43

WINDOWS L I S R E L 8.10

BY

KARL G JORESKOG AND DAG SORBOM

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The following lines were read from file D:\EX\DATA\LISREL\DATA\KIWICH2.SPL:

```
Kiwi Retailing Model
Observed variables:

IIA1 IIA4B IIA7 IIA8 IIIA01 IIIA02 IIIA03 IIIA04 IIIA05
IIIA06 IIIA07 IIIA08 IIIB1 IV01 IV02 IV03 IV04 IV05 IV06
PRODLBSA PRODLBMG PRODSPSA PRODSPMG PRODCPSA PRODCPMG

Correlation matrix from file: D:\EX\data\lisrel\DATA\kiwicor2.txt

Sample Size: 347
Latent Variables:
SIZE CAPITAL SALES MARGIN PRODUCTY E

Paths
SALES  -> IV01 IV02 IV03  IV04
MARGIN -> IV04 IV05 IV06
!MARGIN -> IV01
SIZE   -> IIA1 IIA4B IIA7 IIA8
SIZE   -> IIIB1
CAPITAL -> IIIA02 IIIA07 IIIA08
CAPITAL -> IIIA01
CAPITAL -> SALES
SIZE   -> SALES
SALES  -> MARGIN
!PRODUCTY -> SIZE CAPITAL
!PRODUCTY -> PRODLBMG  PRODSPMG PRODCPMG
!PRODUCTY -> PRODLBSA
!PRODUCTY -> PRODSPSA
!E -> PRODCPSA
!PRODUCTY -> SIZE
!PRODUCTY -> CAPITAL


!set the error covariance of PRODLBSA and PRODLBMG free
!set the error covariance of PRODLBSA and PRODSPSA free
set the error covariance of IIA1 AND IIA4B free
set the error covariance of IIIA01 AND IIIA02 free
!set the error covariance of IIIA07 AND IIIA08 free
set the error covariance of IV01 and IV04 free
set the error covariance of IV02 and IV05 free
!set the error covariance of IV03 and IV06 free
!set the error covariance of IV01 and PRODLBSA free
!set the error covariance of IV02 and PRODLBSA free
```

```
!set the error covariance of IV03 and PRODLBSA free
!set the error covariance of IV01 and PRODSPSA free
!set the error covariance of IV02 and PRODSPSA free
!set the error covariance of IV03 and PRODSPSA free
!set the error variance for CAPITAL = 0.19
!set the error variance for IV06 = 0

!relationships

!IIIA01 = 0.69*CAPITAL


Admissibility Check = 100
!Iterations = 100
Path Diagram
End of Problem

Sample Size =   347

Kiwi Retailing Model
```

CORRELATION MATRIX TO BE ANALYZED

	IV01	IV02	IV03	IV04	IV05	IV06
IV01	1.00					
IV02	0.51	1.00				
IV03	0.71	0.76	1.00			
IV04	0.73	0.38	0.54	1.00		
IV05	0.20	0.50	0.41	0.30	1.00	
IV06	0.35	0.50	0.52	0.47	0.85	1.00
IIA1	0.59	0.56	0.68	0.46	0.31	0.35
IIA4B	0.35	0.33	0.41	0.21	0.16	0.16
IIA7	0.36	0.27	0.40	0.28	0.14	0.21
IIA8	0.67	0.54	0.68	0.55	0.30	0.39
IIIA01	0.55	0.47	0.57	0.47	0.26	0.31
IIIA02	0.51	0.47	0.54	0.36	0.20	0.22
IIIA07	0.66	0.55	0.71	0.48	0.23	0.33
IIIA08	0.81	0.46	0.65	0.60	0.19	0.28
IIIB1	0.21	0.21	0.25	0.12	0.08	0.11

CORRELATION MATRIX TO BE ANALYZED

	IIA1	IIA4B	IIA7	IIA8	IIIA01	IIIA02
IIA1	1.00					
IIA4B	0.60	1.00				
IIA7	0.42	0.29	1.00			
IIA8	0.65	0.40	0.45	1.00		
IIIA01	0.50	0.35	0.28	0.59	1.00	
IIIA02	0.48	0.29	0.26	0.57	0.76	1.00
IIIA07	0.54	0.30	0.32	0.64	0.59	0.58
IIIA08	0.51	0.28	0.27	0.62	0.56	0.54
IIIB1	0.25	0.20	0.16	0.22	0.25	0.28

CORRELATION MATRIX TO BE ANALYZED

	IIIA07	IIIA08	IIIB1
IIIA07	1.00		
IIIA08	0.77	1.00	
IIIB1	0.21	0.21	1.00

```
Kiwi Retailing Model
Number of Iterations = 18

LISREL ESTIMATES (MAXIMUM LIKELIHOOD)
```

```
    IV01 = 0.79*SALES, Errorvar.= 0.38  , R² = 0.62
          (0.075)                (0.033)
           10.56                  11.51

    IV02 = 0.77*SALES, Errorvar.= 0.40  , R² = 0.60
          (0.074)                (0.034)
           10.49                  11.63

    IV03 = 0.94*SALES, Errorvar.= 0.12  , R² = 0.88
          (0.084)                (0.020)
           11.10                  6.19

    IV04 = 0.47*SALES + 0.26*MARGIN, Errorvar.= 0.62  , R² = 0.40
          (0.063)      (0.041)                  (0.048)
           7.35         6.30                     12.86

    IV05 = 0.79*MARGIN, Errorvar.= 0.32  , R² = 0.66
          (0.043)                (0.040)
           18.38                  8.19

    IV06 = 1.04*MARGIN, Errorvar.= -0.085 , R² = 1.08
          (0.052)                (0.054)
           19.96                  -1.57

W_A_R_N_I_N_G : Error variance is negative.

    IIA1 = 0.79*SIZE, Errorvar.= 0.38  , R² = 0.62
          (0.047)                (0.037)
           16.72                  10.18

   IIA4B = 0.48*SIZE, Errorvar.= 0.77  , R² = 0.23
          (0.054)                (0.061)
           8.85                   12.53

    IIA7 = 0.50*SIZE, Errorvar.= 0.75  , R² = 0.25
          (0.053)                (0.060)
           9.38                   12.59

    IIA8 = 0.84*SIZE, Errorvar.= 0.29  , R² = 0.71
          (0.046)                (0.034)
           18.42                  8.43

  IIIA01 = 0.69*CAPITAL, Errorvar.= 0.53  , R² = 0.47
          (0.049)                 (0.044)
           14.09                   11.89

  IIIA02 = 0.66*CAPITAL, Errorvar.= 0.56  , R² = 0.44
          (0.049)                 (0.046)
           13.43                   12.04

  IIIA07 = 0.89*CAPITAL, Errorvar.= 0.22  , R² = 0.78
          (0.044)                 (0.027)
           20.29                   7.96

  IIIA08 = 0.85*CAPITAL, Errorvar.= 0.28  , R² = 0.72
          (0.045)                 (0.030)
           18.99                   9.47

   IIIB1 = 0.29*SIZE, Errorvar.= 0.91  , R² = 0.086
          (0.056)                (0.070)
           5.26                   12.99

Error Covariance for IV04 and IV01 = 0.28
                                     (0.032)
                                       8.54
Error Covariance for IV05 and IV02 = 0.11
                                     (0.019)
                                       5.44
Error Covariance for IIA4B and IIA1 = 0.22
```

(0.037)
5.94
Error Covariance for IIIA02 and IIIA01 = 0.30
(0.037)
8.11

SALES = 0.56*SIZE + 0.39*CAPITAL, Errorvar.= 0.16, R^2 = 0.84
(0.11) (0.087)
5.07 4.52

MARGIN = 0.51*SALES, Errorvar.= 0.74, R^2 = 0.26
(0.069)
7.35

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	SIZE	CAPITAL
SIZE	1.00	
CAPITAL	0.84	1.00
	(0.03)	
	29.90	

COVARIANCE MATRIX OF LATENT VARIABLES

	SALES	MARGIN	SIZE	CAPITAL
SALES	1.00			
MARGIN	0.51	1.00		
SIZE	0.89	0.45	1.00	
CAPITAL	0.86	0.44	0.84	1.00

GOODNESS OF FIT STATISTICS

CHI-SQUARE WITH 81 DEGREES OF FREEDOM = 338.12 (P = 0.0)
ESTIMATED NON-CENTRALITY PARAMETER (NCP) = 257.12

MINIMUM FIT FUNCTION VALUE = 0.98
POPULATION DISCREPANCY FUNCTION VALUE (F0) = 0.74
ROOT MEAN SQUARE ERROR OF APPROXIMATION (RMSEA) = 0.096
P-VALUE FOR TEST OF CLOSE FIT (RMSEA < 0.05) = 0.00000026

EXPECTED CROSS-VALIDATION INDEX (ECVI) = 1.20
ECVI FOR SATURATED MODEL = 0.69
ECVI FOR INDEPENDENCE MODEL = 10.72

CHI-SQUARE FOR INDEPENDENCE MODEL WITH 105 DEGREES OF FREEDOM = 3680.06
INDEPENDENCE AIC = 3710.06
MODEL AIC = 416.12
SATURATED AIC = 240.00
INDEPENDENCE CAIC = 3782.80
MODEL CAIC = 605.24
SATURATED CAIC = 821.92

ROOT MEAN SQUARE RESIDUAL (RMR) = 0.055
STANDARDIZED RMR = 0.055
GOODNESS OF FIT INDEX (GFI) = 0.89
ADJUSTED GOODNESS OF FIT INDEX (AGFI) = 0.83
PARSIMONY GOODNESS OF FIT INDEX (PGFI) = 0.60

NORMED FIT INDEX (NFI) = 0.91
NON-NORMED FIT INDEX (NNFI) = 0.91
PARSIMONY NORMED FIT INDEX (PNFI) = 0.70
COMPARATIVE FIT INDEX (CFI) = 0.93
INCREMENTAL FIT INDEX (IFI) = 0.93
RELATIVE FIT INDEX (RFI) = 0.88

CRITICAL N (CN) = 117.16

CONFIDENCE LIMITS COULD NOT BE COMPUTED DUE TO TOO SMALL P-VALUE FOR CHI-SQUARE

Kiwi Retailing Model

SUMMARY STATISTICS FOR FITTED RESIDUALS
SMALLEST FITTED RESIDUAL = -0.11
MEDIAN FITTED RESIDUAL = 0.00
LARGEST FITTED RESIDUAL = 0.24

STEMLEAF PLOT
-10|4283
- 8|60753
- 6|61061
- 4|8439541100
- 2|76596633211100
- 0|6665542107422100000000000000
0|12334458901144667789
2|2222335661367
4|0459049
6|1778
8|5668
10|2413
12|
14|9
16|
18|
20|
22|8

SUMMARY STATISTICS FOR STANDARDIZED RESIDUALS
SMALLEST STANDARDIZED RESIDUAL = -5.31
MEDIAN STANDARDIZED RESIDUAL = 0.00
LARGEST STANDARDIZED RESIDUAL = 11.62

STEMLEAF PLOT
- 5|32
- 4|61
- 3|75422
- 2|866664443220000
- 1|997653311
- 0|9998876665444322110000000000000000
0|1111122444455566678899
1|002234467889
2|0111679
3|1112567
4|0129
5|7
6|
7|
8|
9|
10|
11|6
LARGEST NEGATIVE STANDARDIZED RESIDUALS
RESIDUAL FOR IV02 AND IV01 -5.31
RESIDUAL FOR IV03 AND IV01 -4.58
RESIDUAL FOR IV04 AND IV02 -3.36
RESIDUAL FOR IV05 AND IV01 -3.72
RESIDUAL FOR IV05 AND IV04 -4.05
RESIDUAL FOR IV06 AND IV04 -2.58
RESIDUAL FOR IIIA08 AND IV02 -5.19
RESIDUAL FOR IIIA08 AND IV03 -3.17
RESIDUAL FOR IIIA08 AND IV05 -3.22
RESIDUAL FOR IIIA08 AND IV06 -3.51
RESIDUAL FOR IIIA08 AND IIA7 -2.77

LARGEST POSITIVE STANDARDIZED RESIDUALS

RESIDUAL FOR	IV03	AND	IV02	4.88
RESIDUAL FOR	IV05	AND	IV02	3.12
RESIDUAL FOR	IV06	AND	IV02	3.54
RESIDUAL FOR	IV06	AND	IV05	3.57
RESIDUAL FOR	IIA8	AND	IV01	4.09
RESIDUAL FOR	IIA8	AND	IV04	3.67
RESIDUAL FOR	IIIA01	AND	IV01	3.13
RESIDUAL FOR	IIIA01	AND	IV04	3.16
RESIDUAL FOR	IIIA01	AND	IIA8	4.19
RESIDUAL FOR	IIIA02	AND	IIA8	3.97
RESIDUAL FOR	IIIA07	AND	IV01	2.94
RESIDUAL FOR	IIIA08	AND	IV01	11.62
RESIDUAL FOR	IIIA08	AND	IV04	5.66
RESIDUAL FOR	IIIA08	AND	IIIA07	3.11
RESIDUAL FOR	IIIB1	AND	IIIA02	2.72

THE MODIFICATION INDICES SUGGEST TO ADD THE

PATH TO	FROM	DECREASE IN CHI-SQUARE	NEW ESTIMATE
IV02	MARGIN	13.4	0.15
IIA8	CAPITAL	13.9	0.52
SALES	MARGIN	10.8	0.13
MARGIN	CAPITAL	13.8	-0.45

THE MODIFICATION INDICES SUGGEST TO ADD AN ERROR COVARIANCE

BETWEEN	AND	DECREASE IN CHI-SQUARE	NEW ESTIMATE
MARGIN	SALES	10.8	0.10
IV03	IV01	11.9	-0.06
IV03	IV02	40.2	0.15
IV06	IV02	16.7	0.12
IIIA08	IV01	79.9	0.16
IIIA08	IV02	21.6	-0.10
IIIA08	IV03	12.1	-0.06
IIIA08	IIIA07	9.7	0.10

THE PROBLEM USED 28848 BYTES (= 1.6% OF AVAILABLE WORKSPACE)

TIME USED: 4.1 SECONDS

Kiwi Retailing Model
Number of Iterations = 8

LISREL ESTIMATES (MAXIMUM LIKELIHOOD)
The error variance for IV06 deleted

IV01 = 0.79*SALES, Errorvar.= 0.38 , R^2 = 0.62
(0.074) (0.033)
10.56 11.53

IV02 = 0.79*SALES, Errorvar.= 0.40 , R^2 = 0.61
(0.074) (0.034)
10.61 11.58

IV03 = 0.94*SALES, Errorvar.= 0.12 , R^2 = 0.88
(0.084) (0.020)
11.11 6.11

IV04 = 0.45*SALES + 0.28*MARGIN, Errorvar.= 0.61 , R^2 = 0.40
(0.062) (0.042) (0.048)
7.21 6.54 12.80

IV05 = 0.83*MARGIN, Errorvar.= 0.27 , R^2 = 0.72
(0.042) (0.021)
19.84 13.15

IV06 = 1.00*MARGIN,, R^2 = 1.00
(0.039)

25.57

IIA1 = 0.79*SIZE, Errorvar.= 0.38 , R^2 = 0.62
(0.047) (0.037)
16.73 10.18

IIA4B = 0.48*SIZE, Errorvar.= 0.77 , R^2 = 0.23
(0.054) (0.061)
8.85 12.53

IIA7 = 0.50*SIZE, Errorvar.= 0.75 , R^2 = 0.25
(0.053) (0.060)
9.37 12.59

IIA8 = 0.84*SIZE, Errorvar.= 0.29 , R^2 = 0.71
(0.046) (0.034)
18.41 8.45

IIIA01 = 0.69*CAPITAL, Errorvar.= 0.52 , R^2 = 0.48
(0.049) (0.044)
14.09 11.89

IIIA02 = 0.66*CAPITAL, Errorvar.= 0.56 , R^2 = 0.44
(0.049) (0.046)
13.44 12.04

IIIA07 = 0.89*CAPITAL, Errorvar.= 0.22 , R^2 = 0.78
(0.044) (0.027)
20.29 7.96

IIIA08 = 0.85*CAPITAL, Errorvar.= 0.28 , R^2 = 0.72
(0.045) (0.030)
18.98 9.47

IIIB1 = 0.29*SIZE, Errorvar.= 0.91 , R^2 = 0.086
(0.056) (0.070)
5.26 12.99

Error Covariance for IV04 and IV01 = 0.28
(0.033)
8.57

Error Covariance for IV05 and IV02 = 0.11
(0.020)
5.49

Error Covariance for IIA4B and IIA1 = 0.22
(0.037)
5.93

Error Covariance for IIIA02 and IIIA01 = 0.30
(0.037)
8.11

SALES = 0.56*SIZE + 0.39*CAPITAL, Errorvar.= 0.16, R^2 = 0.84
(0.11) (0.087)
5.07 4.50

MARGIN = 0.53*SALES, Errorvar.= 0.72, R^2 = 0.28
(0.069)
7.66

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	SIZE	CAPITAL
SIZE	1.00	
CAPITAL	0.84	1.00
	(0.03)	
	29.90	

COVARIANCE MATRIX OF LATENT VARIABLES

	SALES	MARGIN	SIZE	CAPITAL
SALES	1.00			
MARGIN	0.53	1.00		
SIZE	0.89	0.47	1.00	
CAPITAL	0.86	0.46	0.84	1.00

GOODNESS OF FIT STATISTICS

CHI-SQUARE WITH 82 DEGREES OF FREEDOM = 341.09 (P = 0.0)
CHI-SQUARE DIFFERENCE WITH 1 DEGREE OF FREEDOM = 2.97 (P = 0.085)
ESTIMATED NON-CENTRALITY PARAMETER (NCP) = 259.09

MINIMUM FIT FUNCTION VALUE = 0.99
POPULATION DISCREPANCY FUNCTION VALUE (F0) = 0.75
ROOT MEAN SQUARE ERROR OF APPROXIMATION (RMSEA) = 0.096
P-VALUE FOR TEST OF CLOSE FIT (RMSEA < 0.05) = 0.00000040

EXPECTED CROSS-VALIDATION INDEX (ECVI) = 1.21
ECVI FOR SATURATED MODEL = 0.69
ECVI FOR INDEPENDENCE MODEL = 10.72

CHI-SQUARE FOR INDEPENDENCE MODEL WITH 105 DEGREES OF FREEDOM = 3680.06
INDEPENDENCE AIC = 3710.06
MODEL AIC = 417.09
SATURATED AIC = 240.00
INDEPENDENCE CAIC = 3782.80
MODEL CAIC = 601.37
SATURATED CAIC = 821.92

ROOT MEAN SQUARE RESIDUAL (RMR) = 0.057
STANDARDIZED RMR = 0.057
GOODNESS OF FIT INDEX (GFI) = 0.89
ADJUSTED GOODNESS OF FIT INDEX (AGFI) = 0.83
PARSIMONY GOODNESS OF FIT INDEX (PGFI) = 0.61

NORMED FIT INDEX (NFI) = 0.91
NON-NORMED FIT INDEX (NNFI) = 0.91
PARSIMONY NORMED FIT INDEX (PNFI) = 0.71
COMPARATIVE FIT INDEX (CFI) = 0.93
INCREMENTAL FIT INDEX (IFI) = 0.93
RELATIVE FIT INDEX (RFI) = 0.88

CRITICAL N (CN) = 117.35

CONFIDENCE LIMITS COULD NOT BE COMPUTED DUE TO TOO SMALL P-VALUE FOR CHI-SQUARE

Kiwi Retailing Model

SUMMARY STATISTICS FOR FITTED RESIDUALS
SMALLEST FITTED RESIDUAL = -0.14
MEDIAN FITTED RESIDUAL = 0.00
LARGEST FITTED RESIDUAL = 0.24

STEMLEAF PLOT
-14|1
-12|331
-10|633
- 8|372
- 6|6051
- 4|864331085410
- 2|50098766322100
- 0|8866542106432211000000000000000

```
  0|1234579122456677788
  2|11123466178
  4|048906
  6|01788
  8|798
 10|2423
 12|
 14|
 16|0
 18|
 20|
 22|9

SUMMARY STATISTICS FOR STANDARDIZED RESIDUALS
SMALLEST STANDARDIZED RESIDUAL =    -5.55
  MEDIAN STANDARDIZED RESIDUAL =     0.00
 LARGEST STANDARDIZED RESIDUAL =    11.64

STEMLEAF PLOT
- 5|55
- 4|522
- 3|86520
- 2|87655555444300
- 1|99765433210
- 0|9888776666654332110000000000000000000
  0|1111122444555666899
  1|022344668889
  2|111147
  3|0122337
  4|012
  5|7
  6|
  7|
  8|
  9|
 10|
 11|6
LARGEST NEGATIVE STANDARDIZED RESIDUALS
RESIDUAL FOR      IV02 AND      IV01  -5.55
RESIDUAL FOR      IV03 AND      IV01  -4.53
RESIDUAL FOR      IV04 AND      IV02  -3.60
RESIDUAL FOR      IV05 AND      IV01  -4.24
RESIDUAL FOR      IV05 AND      IV04  -4.23
RESIDUAL FOR      IIA8 AND      IV03  -2.65
RESIDUAL FOR    IIIA07 AND      IV05  -3.01
RESIDUAL FOR    IIIA08 AND      IV02  -5.46
RESIDUAL FOR    IIIA08 AND      IV03  -3.19
RESIDUAL FOR    IIIA08 AND      IV05  -3.76
RESIDUAL FOR    IIIA08 AND      IV06  -3.50
RESIDUAL FOR    IIIA08 AND      IIA7  -2.76
LARGEST POSITIVE STANDARDIZED RESIDUALS
RESIDUAL FOR      IV06 AND      IV02   3.31
RESIDUAL FOR      IV06 AND      IV05   3.31
RESIDUAL FOR      IIA8 AND      IV01   4.14
RESIDUAL FOR      IIA8 AND      IV04   3.68
RESIDUAL FOR    IIIA01 AND      IV01   3.16
RESIDUAL FOR    IIIA01 AND      IV04   3.16
RESIDUAL FOR    IIIA01 AND      IIA8   4.19
RESIDUAL FOR    IIIA02 AND      IIA8   3.97
RESIDUAL FOR    IIIA07 AND      IV01   3.01
RESIDUAL FOR    IIIA08 AND      IV01  11.64
RESIDUAL FOR    IIIA08 AND      IV04   5.66
RESIDUAL FOR    IIIA08 AND    IIIA07   3.14
RESIDUAL FOR     IIIB1 AND    IIIA02   2.72

       THE MODIFICATION INDICES SUGGEST TO ADD THE
 PATH TO  FROM      DECREASE IN CHI-SQUARE    NEW ESTIMATE
IV02      MARGIN              10.9                0.14
IIA8      CAPITAL             14.0                0.53
SALES     MARGIN               8.8                0.12
```

MARGIN	CAPITAL	12.8	-0.45

THE MODIFICATION INDICES SUGGEST TO ADD AN ERROR COVARIANCE

BETWEEN	AND	DECREASE IN CHI-SQUARE	NEW ESTIMATE
MARGIN	SALES	8.8	0.09
IV03	IV01	10.9	-0.06
IV03	IV02	39.3	0.15
IV06	IV02	13.4	0.11
IIIA08	IV01	80.0	0.16
IIIA08	IV02	21.0	-0.10
IIIA08	IV03	12.1	-0.06
IIIA08	IIIA07	9.9	0.11

THE PROBLEM USED 28016 BYTES (= 1.5% OF AVAILABLE WORKSPACE)

TIME USED: 2.5 SECONDS

Productivity Model Results

Goodness of Fit Indicators for Productivity Model

CHI-SQUARE WITH 84 DEGREES OF FREEDOM = 342.26 (P = 0.0)
CHI-SQUARE DIFFERENCE WITH 1 DEGREE OF FREEDOM = 2.94 (P = 0.086)
ESTIMATED NON-CENTRALITY PARAMETER (NCP) = 258.26
MINIMUM FIT FUNCTION VALUE = 0.99
POPULATION DISCREPANCY FUNCTION VALUE (F0) = 0.75
ROOT MEAN SQUARE ERROR OF APPROXIMATION (RMSEA) = 0.094
P-VALUE FOR TEST OF CLOSE FIT (RMSEA < 0.05) = 0.00000047
EXPECTED CROSS-VALIDATION INDEX (ECVI) = 1.20
ECVI FOR SATURATED MODEL = 0.69
ECVI FOR INDEPENDENCE MODEL = 10.72
CHI-SQUARE FOR INDEPENDENCE MODEL WITH 105 DEGREES OF FREEDOM = 3680.06
INDEPENDENCE AIC = 3710.06
MODEL AIC = 414.26
SATURATED AIC = 240.00
INDEPENDENCE CAIC = 3782.80
MODEL CAIC = 588.83
SATURATED CAIC = 821.92
ROOT MEAN SQUARE RESIDUAL (RMR) = 0.057
STANDARDIZED RMR = 0.057
GOODNESS OF FIT INDEX (GFI) = 0.89
ADJUSTED GOODNESS OF FIT INDEX (AGFI) = 0.84
PARSIMONY GOODNESS OF FIT INDEX (PGFI) = 0.62
NORMED FIT INDEX (NFI) = 0.91
NON-NORMED FIT INDEX (NNFI) = 0.91
PARSIMONY NORMED FIT INDEX (PNFI) = 0.73
COMPARATIVE FIT INDEX (CFI) = 0.93
INCREMENTAL FIT INDEX (IFI) = 0.93
RELATIVE FIT INDEX (RFI) = 0.88
CRITICAL N (CN) = 119.34

Output File for Productivity Model

DATE: 10/15/95
TIME: 11:03

WINDOWS L I S R E L 8.10

BY

KARL G JORESKOG AND DAG SORBOM

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The following lines were read from file D:\EX\DATA\LISREL\DATA\KIWICH2.SPL:

```
Kiwi Retailing Model
Observed variables:

IIA1 IIA4B IIA7 IIA8 IIIA01 IIIA02 IIIA03 IIIA04 IIIA05
IIIA06 IIIA07 IIIA08 IIIB1 IV01 IV02 IV03 IV04 IV05 IV06
PRODLBSA PRODLBMG PRODSPSA PRODSPMG PRODCPSA PRODCPMG

Correlation matrix from file: D:\EX\data\lisrel\DATA\kiwicor2.txt

Sample Size: 347
Latent Variables:
SIZE CAPITAL SALES MARGIN PRODUCTY E

Paths
SALES  -> IV01 IV02 IV03  IV04
MARGIN -> IV04 IV05 IV06
!MARGIN -> IV01
SIZE  -> IIA1 IIA4B IIA7 IIA8
SIZE  -> IIIB1
CAPITAL -> IIIA02 IIIA07 IIIA08
CAPITAL -> IIIA01
!CAPITAL -> SALES
!SIZE  -> SALES
SALES  -> MARGIN
PRODUCTY -> SIZE CAPITAL
PRODUCTY -> SALES
!PRODUCTY -> PRODLBMG  PRODSPMG PRODCPMG
!PRODUCTY -> PRODLBSA
!PRODUCTY -> PRODSPSA
!E -> PRODCPSA
!PRODUCTY -> SIZE
!PRODUCTY -> CAPITAL


!set the error covariance of PRODLBSA and PRODLBMG free
!set the error covariance of PRODLBSA and PRODSPSA free
set the error covariance of IIA1 AND IIA4B free
set the error covariance of IIIA01 AND IIIA02 free
!set the error covariance of IIIA07 AND IIIA08 free
set the error covariance of IV01 and IV04 free
set the error covariance of IV02 and IV05 free
!set the error covariance of IV03 and IV06 free
!set the error covariance of IV01 and PRODLBSA free
!set the error covariance of IV02 and PRODLBSA free
```

```
!set the error covariance of IV03 and PRODLBSA free
!set the error covariance of IV01 and PRODSPSA free
!set the error covariance of IV02 and PRODSPSA free
!set the error covariance of IV03 and PRODSPSA free
set the error variance for CAPITAL = 0.19
set the error variance for SALES = 0.12

!relationships

IIIA01 = 0.69*CAPITAL
IV01 = 0.79*SALES

Admissibility Check = 100
!Iterations = 100
Path Diagram
End of Problem

Sample Size =  347

Kiwi Retailing Model
```

CORRELATION MATRIX TO BE ANALYZED

	IIA1	IIA4B	IIA7	IIA8	IIIA01	IIIA02
IIA1	1.00					
IIA4B	0.60	1.00				
IIA7	0.42	0.29	1.00			
IIA8	0.65	0.40	0.45	1.00		
IIIA01	0.50	0.35	0.28	0.59	1.00	
IIIA02	0.48	0.29	0.26	0.57	0.76	1.00
IIIA07	0.54	0.30	0.32	0.64	0.59	0.58
IIIA08	0.51	0.28	0.27	0.62	0.56	0.54
IIIB1	0.25	0.20	0.16	0.22	0.25	0.28
IV01	0.59	0.35	0.36	0.67	0.55	0.51
IV02	0.56	0.33	0.27	0.54	0.47	0.47
IV03	0.68	0.41	0.40	0.68	0.57	0.54
IV04	0.46	0.21	0.28	0.55	0.47	0.36
IV05	0.31	0.16	0.14	0.30	0.26	0.20
IV06	0.35	0.16	0.21	0.39	0.31	0.22

CORRELATION MATRIX TO BE ANALYZED

	IIIA07	IIIA08	IIIB1	IV01	IV02	IV03
IIIA07	1.00					
IIIA08	0.77	1.00				
IIIB1	0.21	0.21	1.00			
IV01	0.66	0.81	0.21	1.00		
IV02	0.55	0.46	0.21	0.51	1.00	
IV03	0.71	0.65	0.25	0.71	0.76	1.00
IV04	0.48	0.60	0.12	0.73	0.38	0.54
IV05	0.23	0.19	0.08	0.20	0.50	0.41
IV06	0.33	0.28	0.11	0.35	0.50	0.52

CORRELATION MATRIX TO BE ANALYZED

	IV04	IV05	IV06
IV04	1.00		
IV05	0.30	1.00	
IV06	0.47	0.85	1.00

```
Kiwi Retailing Model
Number of Iterations = 37

LISREL ESTIMATES (MAXIMUM LIKELIHOOD)
```

```
 IIA1 = 0.79*SIZE, Errorvar.= 0.38  , R² = 0.62
       (0.13)                (0.037)
        6.18                  10.23

IIA4B = 0.48*SIZE, Errorvar.= 0.77  , R² = 0.23
       (0.090)               (0.062)
        5.31                  12.54

 IIA7 = 0.50*SIZE, Errorvar.= 0.75  , R² = 0.25
       (0.091)               (0.060)
        5.47                  12.59

 IIA8 = 0.85*SIZE, Errorvar.= 0.28  , R² = 0.72
       (0.14)                (0.034)
        6.15                  8.34

IIIA01 = 0.69*CAPITAL, Errorvar.= 0.52  , R² = 0.48
                                 (0.044)
                                  11.91

IIIA02 = 0.66*CAPITAL, Errorvar.= 0.56  , R² = 0.45
        (0.037)                  (0.046)
         17.81                    12.03

IIIA07 = 0.88*CAPITAL, Errorvar.= 0.22  , R² = 0.79
        (0.053)                  (0.027)
         16.62                    7.97

IIIA08 = 0.84*CAPITAL, Errorvar.= 0.28  , R² = 0.72
        (0.052)                  (0.030)
         16.08                    9.47

 IIIB1 = 0.29*SIZE, Errorvar.= 0.91  , R² = 0.086
        (0.071)               (0.070)
         4.15                  12.99

  IV01 = 0.79*SALES, Errorvar.= 0.39  , R² = 0.62
                               (0.034)
                                11.55

  IV02 = 0.78*SALES, Errorvar.= 0.39  , R² = 0.61
        (0.047)                (0.034)
         16.35                  11.59

  IV03 = 0.94*SALES, Errorvar.= 0.11  , R² = 0.89
        (0.046)                (0.020)
         20.43                  5.85

  IV04 = 0.47*SALES + 0.26*MARGIN, Errorvar.= 0.62  , R² = 0.40
        (0.043)      (0.041)                  (0.048)
         10.79        6.31                     12.87

  IV05 = 0.80*MARGIN, Errorvar.= 0.32  , R² = 0.66
        (0.043)                (0.039)
         18.44                  8.22

  IV06 = 1.04*MARGIN, Errorvar.= -0.084 , R² = 1.08
        (0.052)                  (0.053)
         20.01                   -1.56

W_A_R_N_I_N_G : Error variance is negative.

Error Covariance for IIA4B and IIA1 = 0.22
                                     (0.037)
                                      5.98

Error Covariance for IIIA02 and IIIA01 = 0.30
                                        (0.037)
                                         8.09

Error Covariance for IV04 and IV01 = 0.28
                                    (0.033)
```

Error Covariance for IV05 and IV02 = 8.62
0.11
(0.019)
5.45

SIZE = 0.94*PRODUCTY, Errorvar.= 0.12, R^2 = 0.88
(0.16)
5.69

CAPITAL = 0.91*PRODUCTY, Errorvar.= 0.19, R^2 = 0.81
(0.068)
13.40

SALES = 0.94*PRODUCTY, Errorvar.= 0.12, R^2 = 0.88
(0.060)
15.63

MARGIN = 0.51*SALES, Errorvar.= 0.74, R^2 = 0.26
(0.058)
8.77

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	PRODUCTY
	1.00

COVARIANCE MATRIX OF LATENT VARIABLES

	SIZE	CAPITAL	SALES	MARGIN	PRODUCTY
SIZE	1.00				
CAPITAL	0.85	1.02			
SALES	0.88	0.86	1.01		
MARGIN	0.45	0.44	0.51	1.00	
PRODUCTY	0.94	0.91	0.94	0.48	1.00

GOODNESS OF FIT STATISTICS

CHI-SQUARE WITH 83 DEGREES OF FREEDOM = 339.32 (P = 0.0)
ESTIMATED NON-CENTRALITY PARAMETER (NCP) = 256.32

MINIMUM FIT FUNCTION VALUE = 0.98
POPULATION DISCREPANCY FUNCTION VALUE (F0) = 0.74
ROOT MEAN SQUARE ERROR OF APPROXIMATION (RMSEA) = 0.094
P-VALUE FOR TEST OF CLOSE FIT (RMSEA < 0.05) = 0.00000031

EXPECTED CROSS-VALIDATION INDEX (ECVI) = 1.19
ECVI FOR SATURATED MODEL = 0.69
ECVI FOR INDEPENDENCE MODEL = 10.72

CHI-SQUARE FOR INDEPENDENCE MODEL WITH 105 DEGREES OF FREEDOM = 3680.06
INDEPENDENCE AIC = 3710.06
MODEL AIC = 413.32
SATURATED AIC = 240.00
INDEPENDENCE CAIC = 3782.80
MODEL CAIC = 592.74
SATURATED CAIC = 821.92

ROOT MEAN SQUARE RESIDUAL (RMR) = 0.055
STANDARDIZED RMR = 0.055
GOODNESS OF FIT INDEX (GFI) = 0.89
ADJUSTED GOODNESS OF FIT INDEX (AGFI) = 0.84
PARSIMONY GOODNESS OF FIT INDEX (PGFI) = 0.62

NORMED FIT INDEX (NFI) = 0.91
NON-NORMED FIT INDEX (NNFI) = 0.91

```
PARSIMONY NORMED FIT INDEX (PNFI) = 0.72
COMPARATIVE FIT INDEX (CFI) = 0.93
INCREMENTAL FIT INDEX (IFI) = 0.93
RELATIVE FIT INDEX (RFI) = 0.88

CRITICAL N (CN) = 119.16

CONFIDENCE LIMITS COULD NOT BE COMPUTED DUE TO TOO SMALL P-VALUE FOR CHI-SQUARE


Kiwi Retailing Model

SUMMARY STATISTICS FOR FITTED RESIDUALS
SMALLEST FITTED RESIDUAL =    -0.12
  MEDIAN FITTED RESIDUAL =     0.00
 LARGEST FITTED RESIDUAL =     0.25

STEMLEAF PLOT
-10|9544
- 8|94165
- 6|41760
- 4|9763851
- 2|9866533987766654 20
- 0|8865444338655422111100000000
  0|14456666901255667888 99
  2|45577889029
  4|12230
  6|12234
  8|017033
 10|002
 12|
 14|
 16|5
 18|
 20|
 22|
 24|5

SUMMARY STATISTICS FOR STANDARDIZED RESIDUALS
SMALLEST STANDARDIZED RESIDUAL =   -5.03
  MEDIAN STANDARDIZED RESIDUAL =    0.00
 LARGEST STANDARDIZED RESIDUAL =   11.03

STEMLEAF PLOT
- 5|0
- 4|41
- 3|8520
- 2|87644333210000
- 1|98886541100
- 0|9998887766644443322111110000000000 0
  0|22222224445555666678 9
  1|0233333444489 99
  2|13479
  3|000444667
  4|0
  5|6
  6|
  7|
  8|
  9|
 10|
 11|0
LARGEST NEGATIVE STANDARDIZED RESIDUALS
RESIDUAL FOR   IIIA08 AND     IIA7  -2.82
RESIDUAL FOR     IV02 AND   IIIA08  -4.37
RESIDUAL FOR     IV02 AND     IV01  -5.03
RESIDUAL FOR     IV04 AND     IV02  -3.47
RESIDUAL FOR     IV05 AND   IIIA08  -3.05
RESIDUAL FOR     IV05 AND     IV01  -3.78
```

```
RESIDUAL FOR      IV05 AND      IV04   -4.13
RESIDUAL FOR      IV06 AND    IIIA08   -3.20
RESIDUAL FOR      IV06 AND      IV01   -2.65
RESIDUAL FOR      IV06 AND      IV04   -2.67
LARGEST POSITIVE STANDARDIZED RESIDUALS
RESIDUAL FOR    IIIA01 AND      IIA8    3.45
RESIDUAL FOR    IIIA02 AND      IIA8    3.57
RESIDUAL FOR     IIIB1 AND    IIIA02    2.67
RESIDUAL FOR      IV01 AND      IIA8    4.01
RESIDUAL FOR      IV01 AND    IIIA01    2.86
RESIDUAL FOR      IV01 AND    IIIA07    3.05
RESIDUAL FOR      IV01 AND    IIIA08   11.03
RESIDUAL FOR      IV03 AND      IV02    3.58
RESIDUAL FOR      IV04 AND      IIA8    3.65
RESIDUAL FOR      IV04 AND    IIIA01    3.04
RESIDUAL FOR      IV04 AND    IIIA08    5.61
RESIDUAL FOR      IV05 AND      IV02    2.98
RESIDUAL FOR      IV06 AND      IV02    3.37
RESIDUAL FOR      IV06 AND      IV05    3.36

       THE MODIFICATION INDICES SUGGEST TO ADD THE
 PATH TO   FROM       DECREASE IN CHI-SQUARE    NEW ESTIMATE
IIA7       CAPITAL              8.1                -0.37
IV01       SIZE                 8.1                 0.24
IV01       CAPITAL             35.9                 0.43
IV02       CAPITAL             11.9                -0.30
IV02       MARGIN              12.4                 0.14
CAPITAL    MARGIN               9.0                -0.12
MARGIN     CAPITAL             11.5                -0.37
MARGIN     PRODUCTY             8.1                -0.67

THE MODIFICATION INDICES SUGGEST TO ADD AN ERROR COVARIANCE
 BETWEEN     AND      DECREASE IN CHI-SQUARE    NEW ESTIMATE
MARGIN     CAPITAL              9.8                -0.09
MARGIN     SALES                8.1                 0.09
IIIA08     IIIA07               8.1                 0.09
IV01       IIIA08              77.6                 0.15
IV02       IIIA08              19.4                -0.09
IV03       IIIA08              10.2                -0.05
IV03       IV01                10.9                -0.06
IV03       IV02                27.5                 0.12
IV06       IV02                15.6                 0.12


         THE PROBLEM USED    29696 BYTES (=  1.6% OF AVAILABLE WORKSPACE)

                          TIME USED:     4.9 SECONDS


Kiwi Retailing Model
Number of Iterations =  7

LISREL ESTIMATES (MAXIMUM LIKELIHOOD)
The error variance for IV06 deleted

    IIA1 = 0.79*SIZE, Errorvar.= 0.38  , R² = 0.62
          (0.13)                (0.037)
           6.16                  10.22

   IIA4B = 0.48*SIZE, Errorvar.= 0.77  , R² = 0.23
          (0.090)               (0.062)
           5.30                  12.54

    IIA7 = 0.50*SIZE, Errorvar.= 0.75  , R² = 0.25
          (0.091)               (0.060)
           5.45                  12.59

    IIA8 = 0.85*SIZE, Errorvar.= 0.28  , R² = 0.72
          (0.14)                (0.034)
```

```
          6.13                    8.35

 IIIA01 = 0.69*CAPITAL, Errorvar.= 0.52   , R² = 0.48
                                  (0.044)
                                   11.91

 IIIA02 = 0.66*CAPITAL, Errorvar.= 0.56   , R² = 0.45
         (0.037)                  (0.046)
          17.81                    12.03

 IIIA07 = 0.88*CAPITAL, Errorvar.= 0.22   , R² = 0.79
         (0.053)                  (0.027)
          16.62                    7.97

 IIIA08 = 0.84*CAPITAL, Errorvar.= 0.28   , R² = 0.72
         (0.052)                  (0.030)
          16.08                    9.48

  IIIB1 = 0.29*SIZE, Errorvar.= 0.91   , R² = 0.086
         (0.071)                (0.070)
          4.14                   12.99

   IV01 = 0.79*SALES, Errorvar.= 0.39   , R² = 0.62
                                 (0.034)
                                  11.57

   IV02 = 0.79*SALES, Errorvar.= 0.39   , R² = 0.62
         (0.047)                  (0.034)
          16.71                    11.54

   IV03 = 0.94*SALES, Errorvar.= 0.11   , R² = 0.89
         (0.046)                  (0.020)
          20.38                    5.76

   IV04 = 0.45*SALES + 0.28*MARGIN, Errorvar.= 0.62   , R² = 0.40
         (0.043)      (0.043)                  (0.048)
          10.47        6.55                     12.81

   IV05 = 0.83*MARGIN, Errorvar.= 0.27   , R² = 0.72
         (0.042)                  (0.021)
          19.86                    13.15

   IV06 = 1.00*MARGIN,, R² = 1.00
         (0.039)
          25.57

Error Covariance for IIA4B and IIA1 = 0.22
                                     (0.037)
                                      5.97
Error Covariance for IIIA02 and IIIA01 = 0.30
                                        (0.037)
                                         8.09
Error Covariance for IV04 and IV01 = 0.29
                                    (0.033)
                                     8.65
Error Covariance for IV05 and IV02 = 0.11
                                    (0.019)
                                     5.49

    SIZE = 0.94*PRODUCTY, Errorvar.= 0.12, R² = 0.88
         (0.16)
          5.67

 CAPITAL = 0.91*PRODUCTY, Errorvar.= 0.19, R² = 0.81
         (0.068)
          13.40

   SALES = 0.94*PRODUCTY, Errorvar.= 0.12, R² = 0.88
         (0.060)
          15.59
```

MARGIN = 0.53*SALES, Errorvar.= 0.72, R^2 = 0.28
(0.057)
9.28

CORRELATION MATRIX OF INDEPENDENT VARIABLES

	PRODUCTY
	1.00

COVARIANCE MATRIX OF LATENT VARIABLES

	SIZE	CAPITAL	SALES	MARGIN	PRODUCTY
SIZE	1.00				
CAPITAL	0.85	1.02			
SALES	0.88	0.86	1.00		
MARGIN	0.47	0.45	0.53	1.00	
PRODUCTY	0.94	0.91	0.94	0.50	1.00

GOODNESS OF FIT STATISTICS

CHI-SQUARE WITH 84 DEGREES OF FREEDOM = 342.26 (P = 0.0)
CHI-SQUARE DIFFERENCE WITH 1 DEGREE OF FREEDOM = 2.94 (P = 0.086)
ESTIMATED NON-CENTRALITY PARAMETER (NCP) = 258.26

MINIMUM FIT FUNCTION VALUE = 0.99
POPULATION DISCREPANCY FUNCTION VALUE (F0) = 0.75
ROOT MEAN SQUARE ERROR OF APPROXIMATION (RMSEA) = 0.094
P-VALUE FOR TEST OF CLOSE FIT (RMSEA < 0.05) = 0.00000047

EXPECTED CROSS-VALIDATION INDEX (ECVI) = 1.20
ECVI FOR SATURATED MODEL = 0.69
ECVI FOR INDEPENDENCE MODEL = 10.72

CHI-SQUARE FOR INDEPENDENCE MODEL WITH 105 DEGREES OF FREEDOM = 3680.06
INDEPENDENCE AIC = 3710.06
MODEL AIC = 414.26
SATURATED AIC = 240.00
INDEPENDENCE CAIC = 3782.80
MODEL CAIC = 588.83
SATURATED CAIC = 821.92

ROOT MEAN SQUARE RESIDUAL (RMR) = 0.057
STANDARDIZED RMR = 0.057
GOODNESS OF FIT INDEX (GFI) = 0.89
ADJUSTED GOODNESS OF FIT INDEX (AGFI) = 0.84
PARSIMONY GOODNESS OF FIT INDEX (PGFI) = 0.62

NORMED FIT INDEX (NFI) = 0.91
NON-NORMED FIT INDEX (NNFI) = 0.91
PARSIMONY NORMED FIT INDEX (PNFI) = 0.73
COMPARATIVE FIT INDEX (CFI) = 0.93
INCREMENTAL FIT INDEX (IFI) = 0.93
RELATIVE FIT INDEX (RFI) = 0.88

CRITICAL N (CN) = 119.34

CONFIDENCE LIMITS COULD NOT BE COMPUTED DUE TO TOO SMALL P-VALUE FOR CHI-SQUARE

Kiwi Retailing Model

SUMMARY STATISTICS FOR FITTED RESIDUALS
SMALLEST FITTED RESIDUAL = -0.15

```
 MEDIAN FITTED RESIDUAL =     0.00
LARGEST FITTED RESIDUAL =     0.25

STEMLEAF PLOT
-14|5
-12|07
-10|430
- 8|9865
- 6|3060
- 4|97652198531
- 2|96519977777766542
- 0|998654433766543211111000000
  0|1123445679114566778888
  2|002588288
  4|12460
  6|22334
  8|23934
 10|103
 12|
 14|
 16|5
 18|
 20|
 22|
 24|7

SUMMARY STATISTICS FOR STANDARDIZED RESIDUALS
SMALLEST STANDARDIZED RESIDUAL =    -5.25
  MEDIAN STANDARDIZED RESIDUAL =    -0.04
 LARGEST STANDARDIZED RESIDUAL =    11.05

STEMLEAF PLOT
- 5|3
- 4|633
- 3|762
- 2|8866433333200000
- 1|998643211000
- 0|998877777666644422221111000000000000
  0|1122222445555666778
  1|033333444557899
  2|01379
  3|11111567
  4|1
  5|6
  6|
  7|
  8|
  9|
 10|
 11|1
LARGEST NEGATIVE STANDARDIZED RESIDUALS
RESIDUAL FOR    IIIA08 AND      IIA7  -2.82
RESIDUAL FOR      IV02 AND    IIIA08  -4.63
RESIDUAL FOR      IV02 AND      IV01  -5.25
RESIDUAL FOR      IV04 AND      IV02  -3.69
RESIDUAL FOR      IV05 AND    IIIA07  -2.84
RESIDUAL FOR      IV05 AND    IIIA08  -3.57
RESIDUAL FOR      IV05 AND      IV01  -4.28
RESIDUAL FOR      IV05 AND      IV04  -4.29
RESIDUAL FOR      IV06 AND    IIIA08  -3.19
RESIDUAL FOR      IV06 AND      IV01  -2.61
RESIDUAL FOR      IV06 AND      IV04  -2.61
LARGEST POSITIVE STANDARDIZED RESIDUALS
RESIDUAL FOR    IIIA01 AND      IIA8   3.46
RESIDUAL FOR    IIIA02 AND      IIA8   3.58
RESIDUAL FOR     IIIB1 AND    IIIA02   2.67
RESIDUAL FOR      IV01 AND      IIA8   4.06
RESIDUAL FOR      IV01 AND    IIIA01   2.90
RESIDUAL FOR      IV01 AND    IIIA07   3.11
RESIDUAL FOR      IV01 AND    IIIA08  11.05
```

RESIDUAL FOR	IV04 AND	IIA8	3.66
RESIDUAL FOR	IV04 AND	IIIA01	3.05
RESIDUAL FOR	IV04 AND	IIIA08	5.61
RESIDUAL FOR	IV06 AND	IV02	3.14
RESIDUAL FOR	IV06 AND	IV05	3.09

THE MODIFICATION INDICES SUGGEST TO ADD THE

PATH TO	FROM	DECREASE IN CHI-SQUARE	NEW ESTIMATE
IIA7	CAPITAL	8.1	-0.37
IV01	SIZE	8.7	0.25
IV01	CAPITAL	36.6	0.43
IV02	CAPITAL	11.2	-0.29
IV02	MARGIN	10.1	0.14
CAPITAL	MARGIN	8.9	-0.12
MARGIN	CAPITAL	10.7	-0.37

THE MODIFICATION INDICES SUGGEST TO ADD AN ERROR COVARIANCE

BETWEEN	AND	DECREASE IN CHI-SQUARE	NEW ESTIMATE
MARGIN	CAPITAL	9.8	-0.10
IIIA08	IIIA07	8.2	0.09
IV01	IIIA08	77.7	0.15
IV02	IIIA08	18.8	-0.09
IV03	IIIA08	10.2	-0.05
IV03	IV01	10.0	-0.06
IV03	IV02	26.8	0.12
IV06	IV02	12.5	0.10

THE PROBLEM USED 28936 BYTES (= 1.6% OF AVAILABLE WORKSPACE)
TIME USED: 2.9 SECONDS

Lisrel Model Results: Figures

Figure 13 Measurement Model Estimates

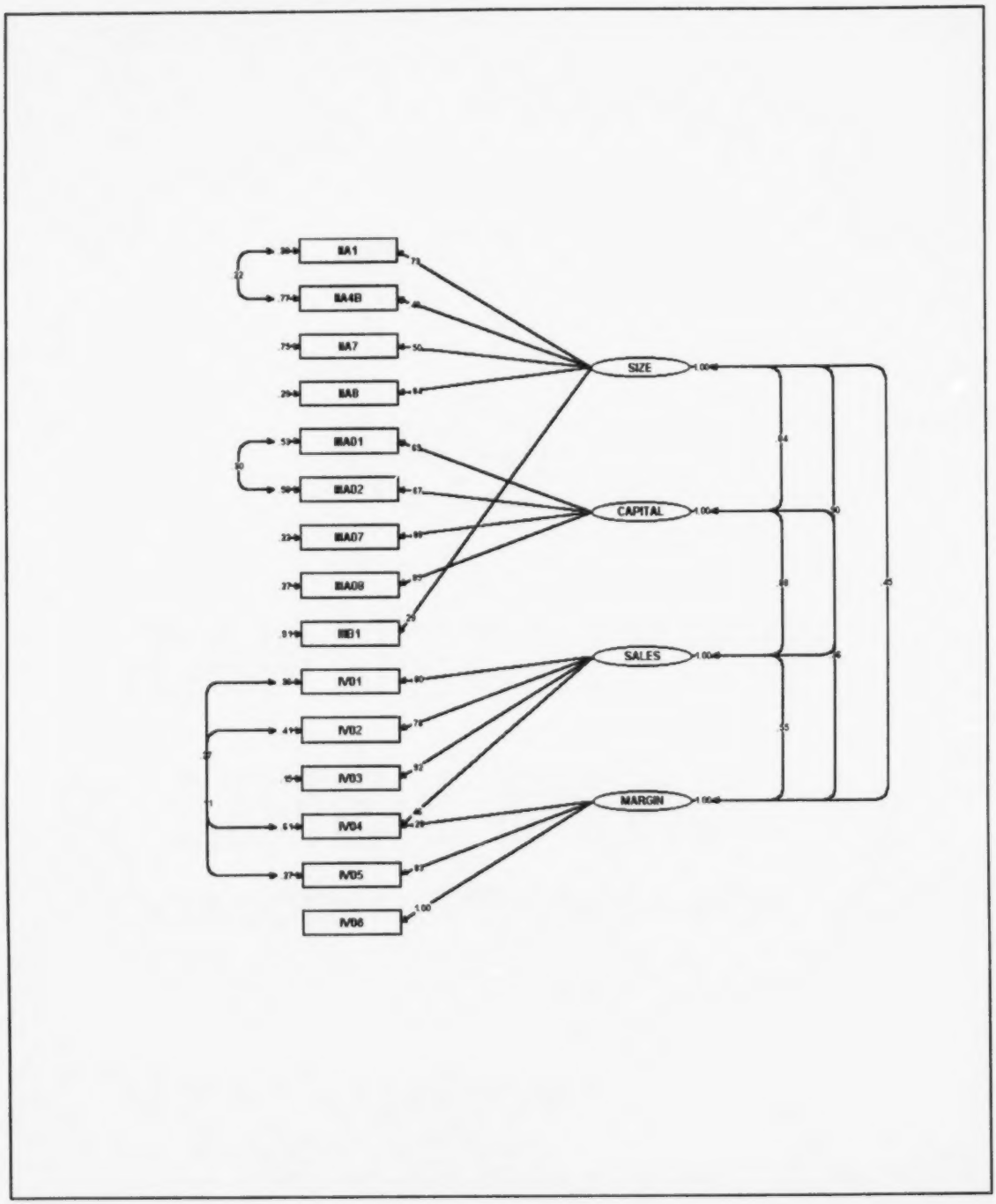

Figure 14 Measurement Model T-Values

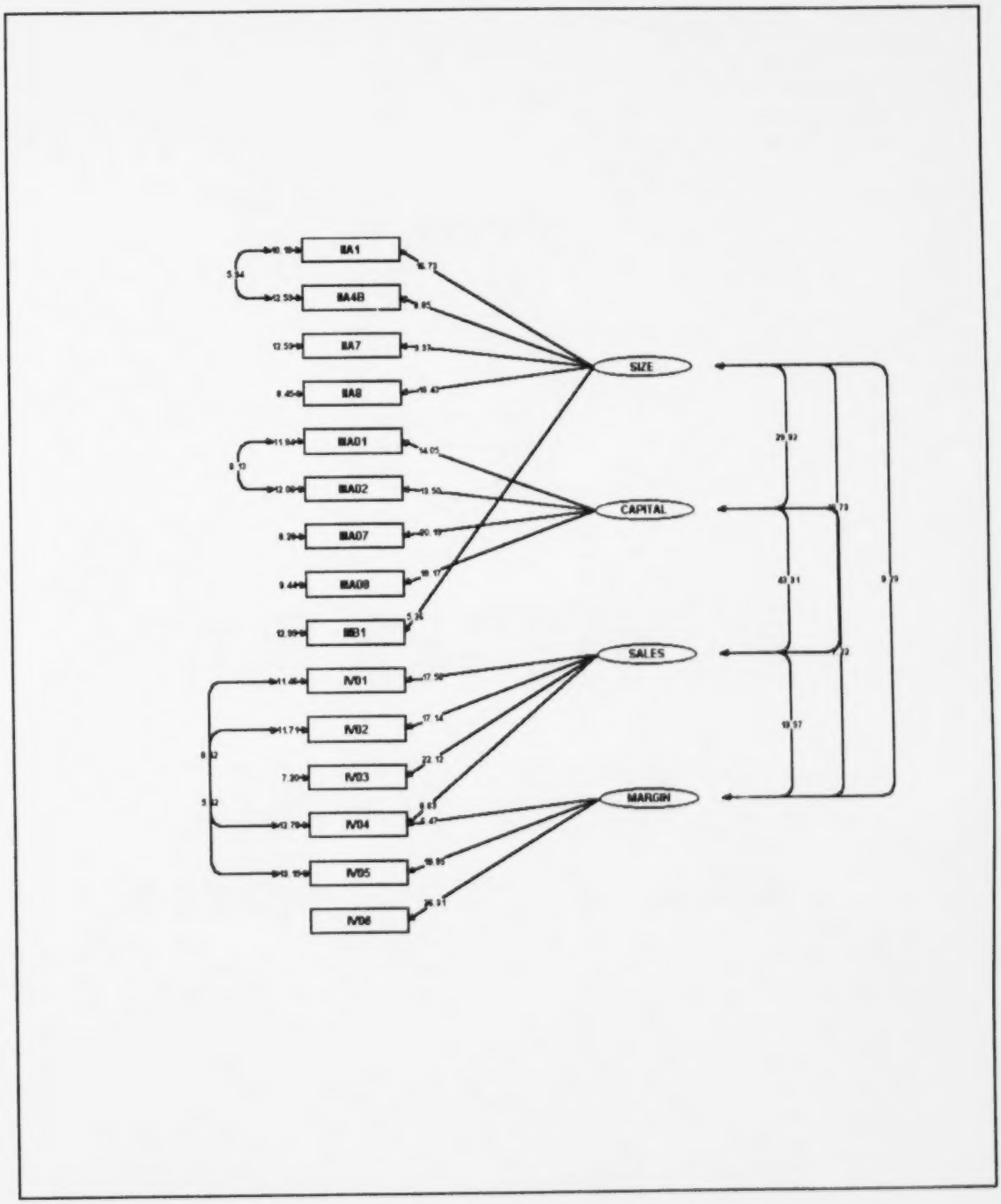

Figure 15 Direct Model Path Estimates

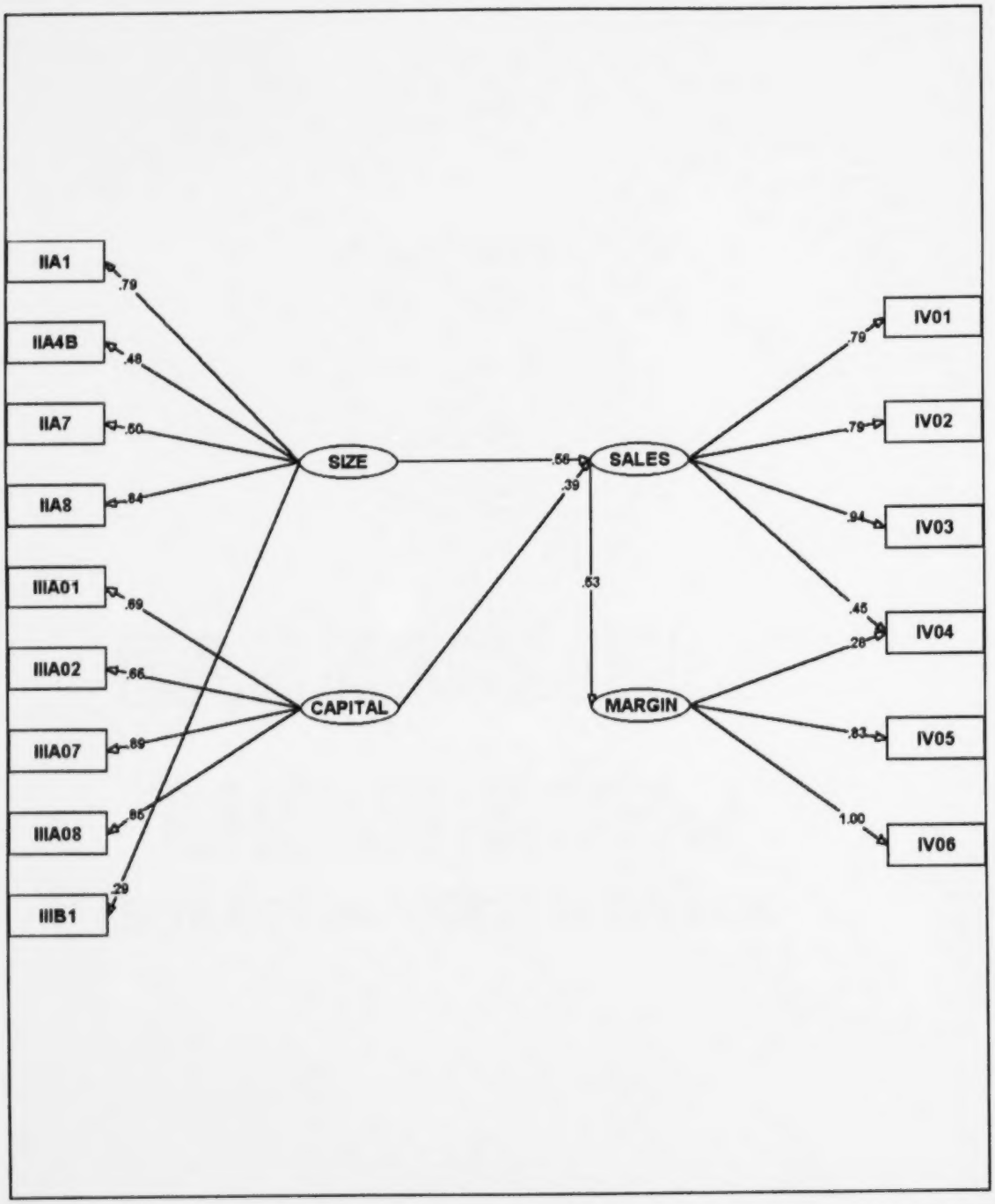

Figure 16 Direct Model Path T-Values

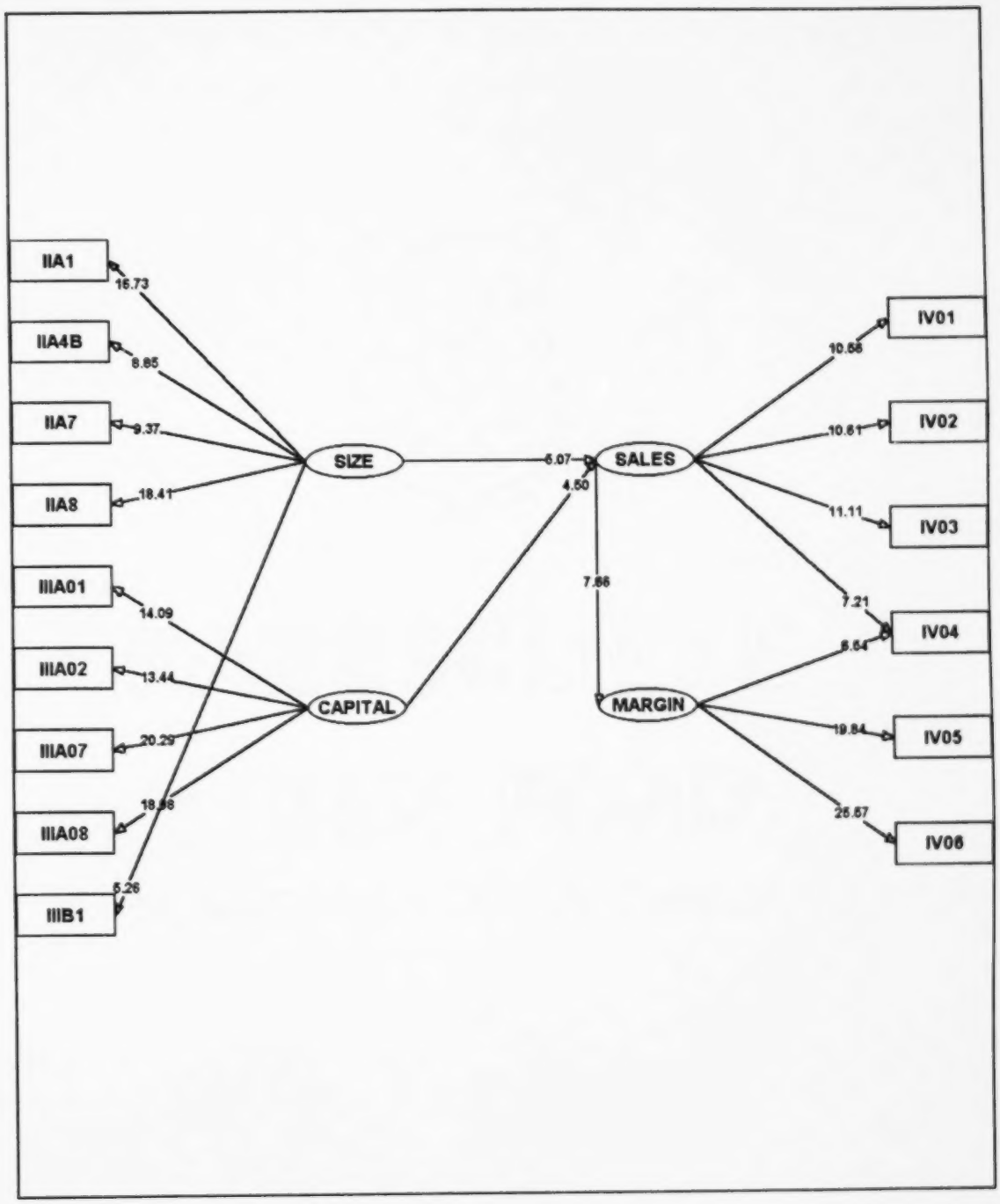

Figure 17 Direct Model Structural Estimates

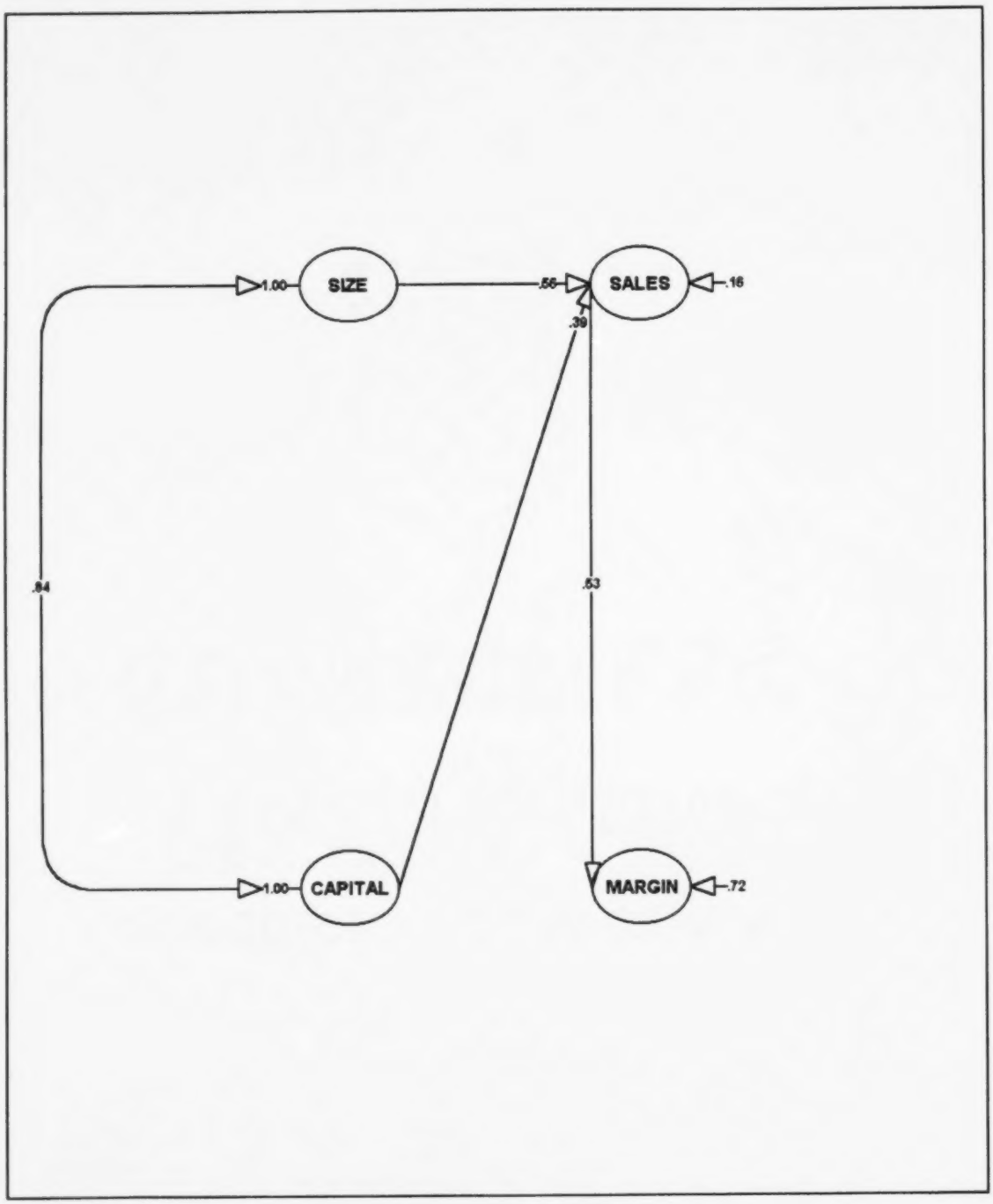

Figure 18 Direct Model Structural T-Values

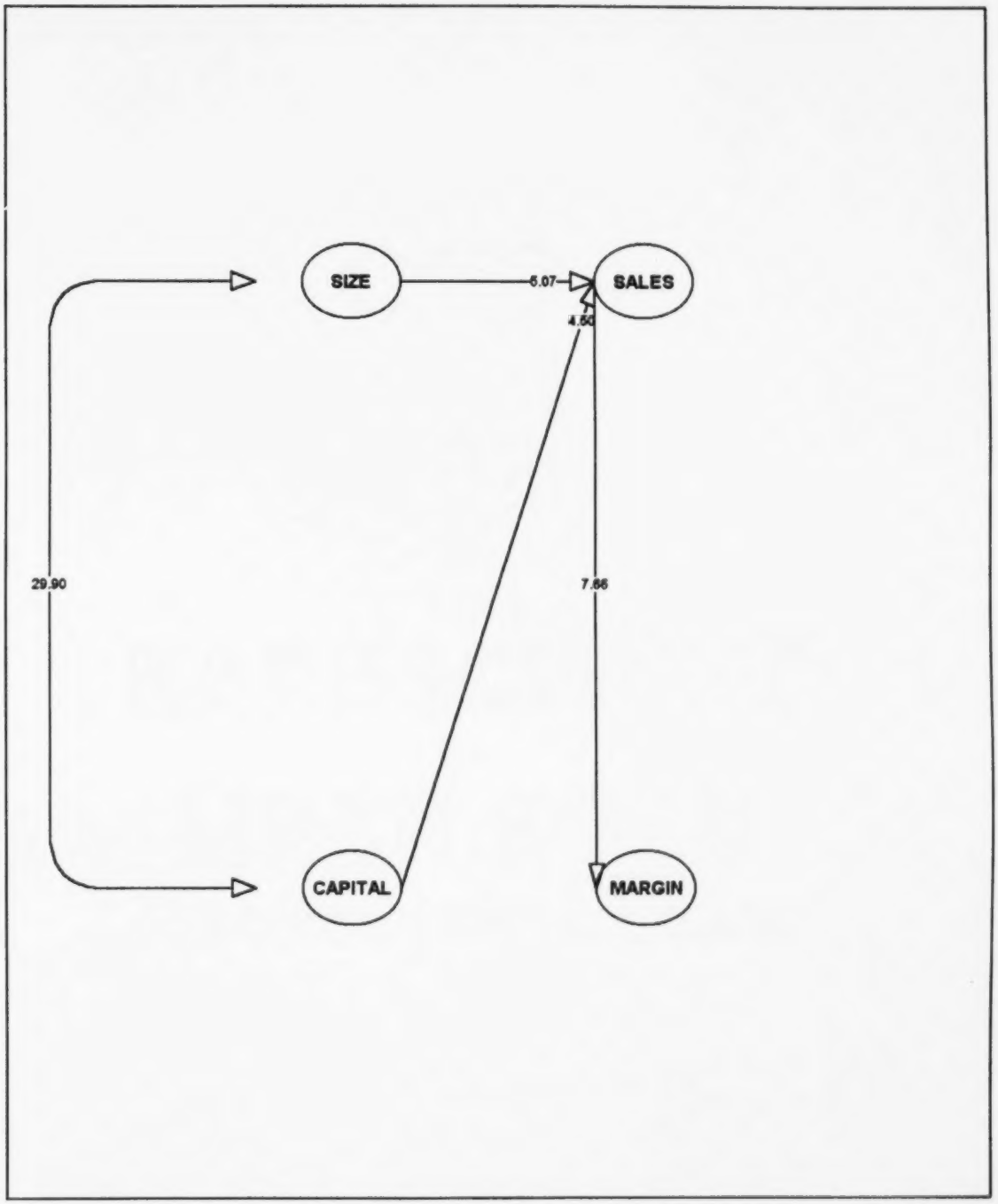

Figure 19 Direct Model Correlated Error Estimates

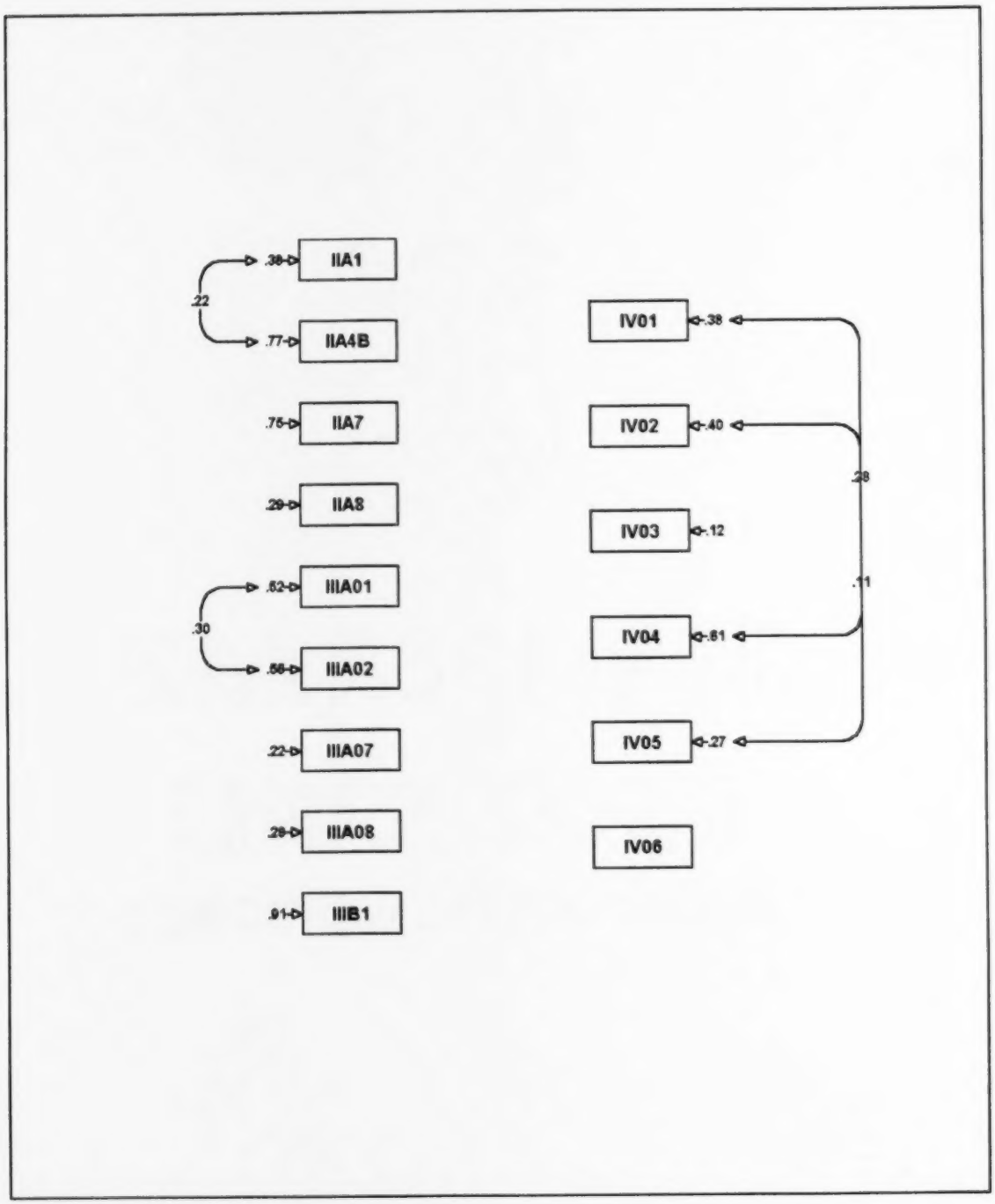

Figure 20 Direct Model Correlated Error T-Values

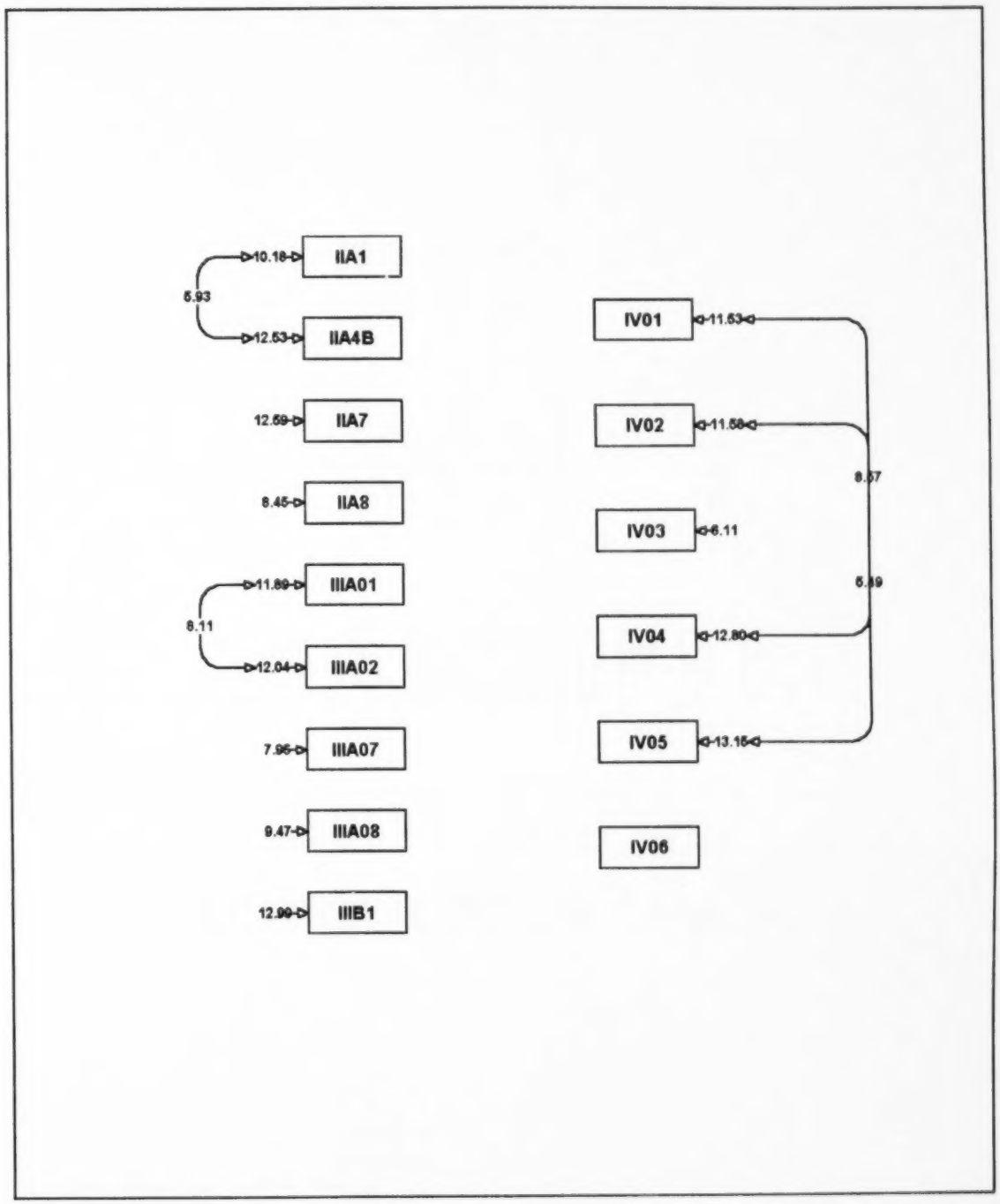

Figure 21 Productivity Model Path Estimates

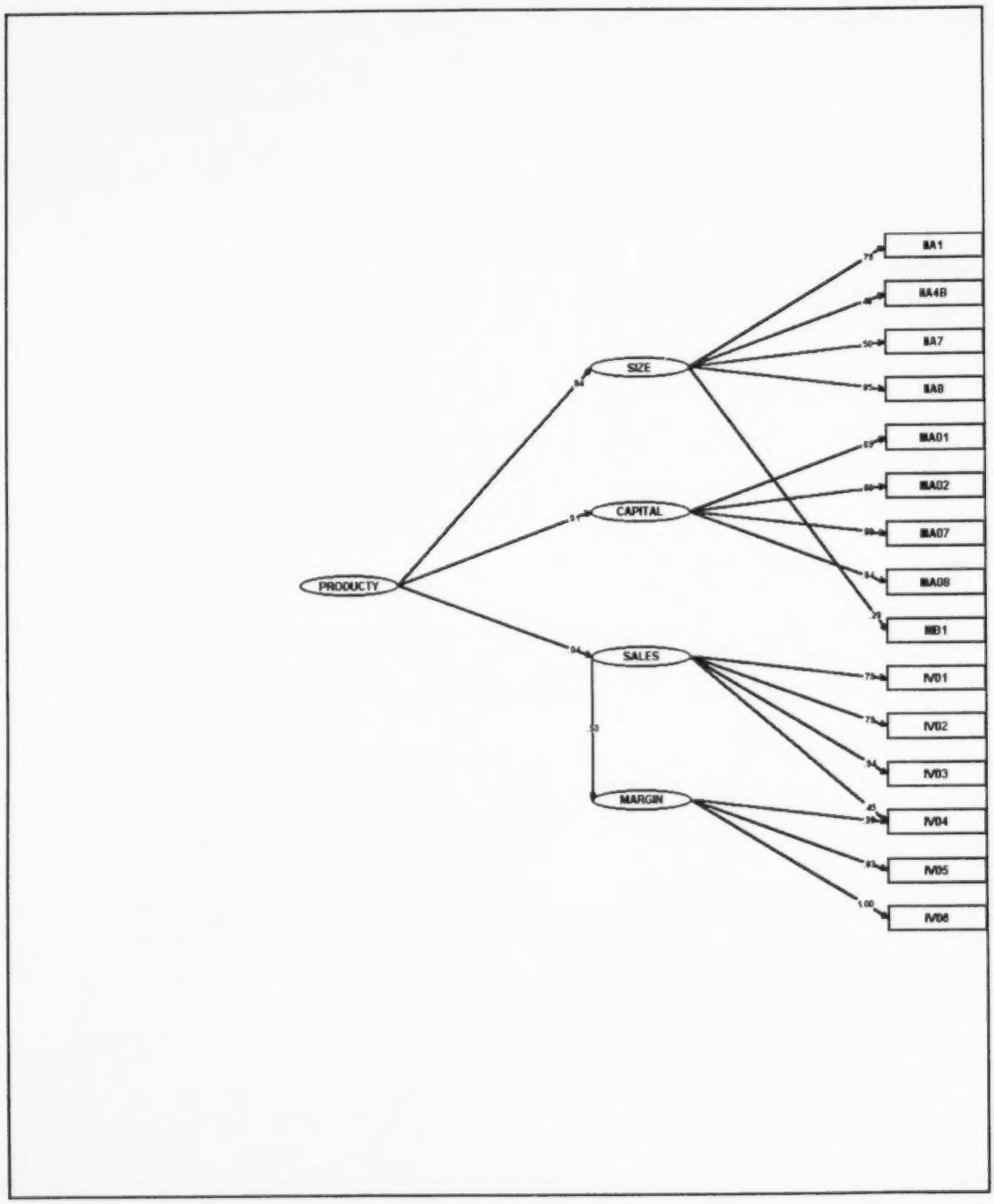

Figure 22 Productivity Model Path T-Values

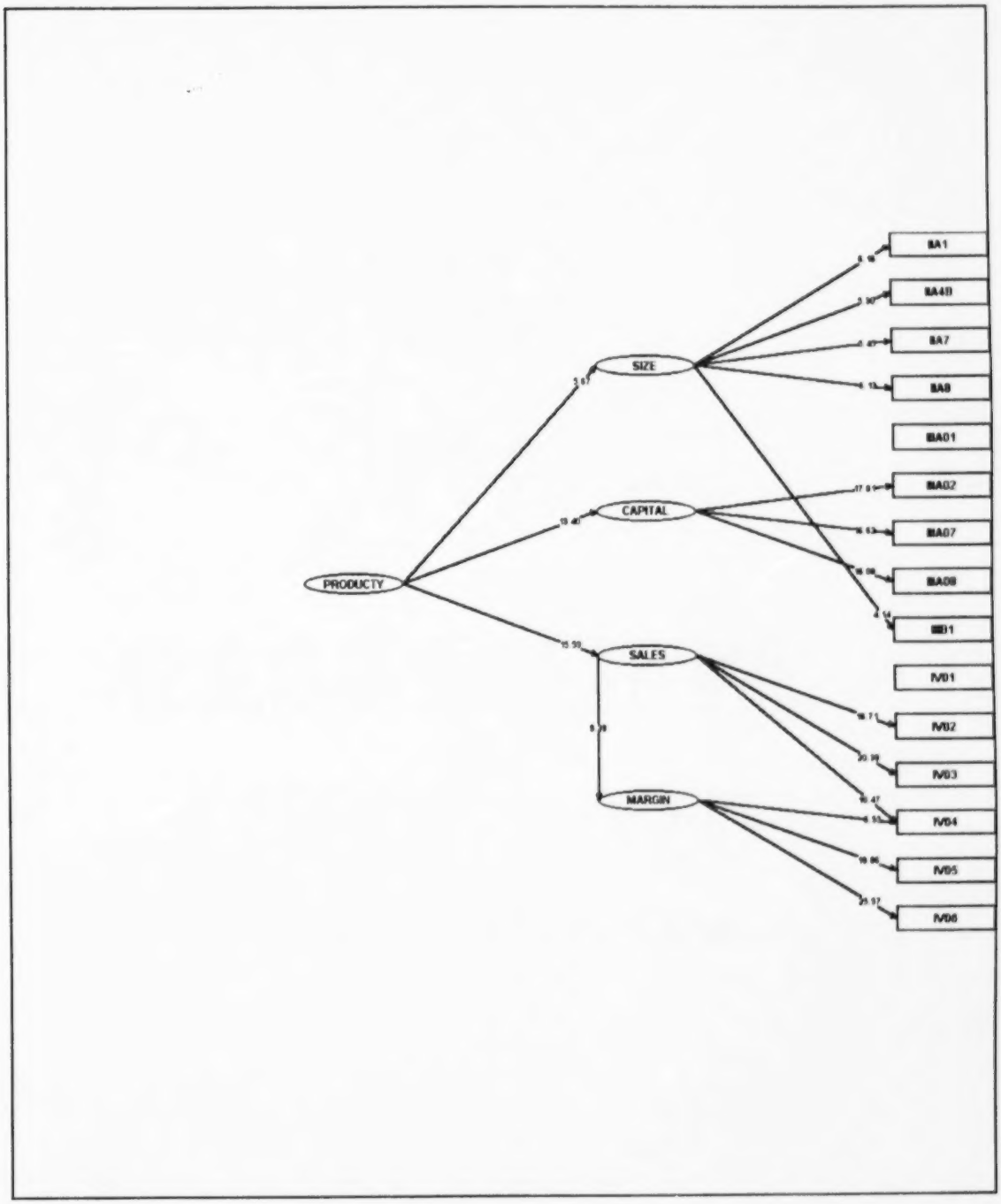

Figure 23 Productivity Model Structural Estimates

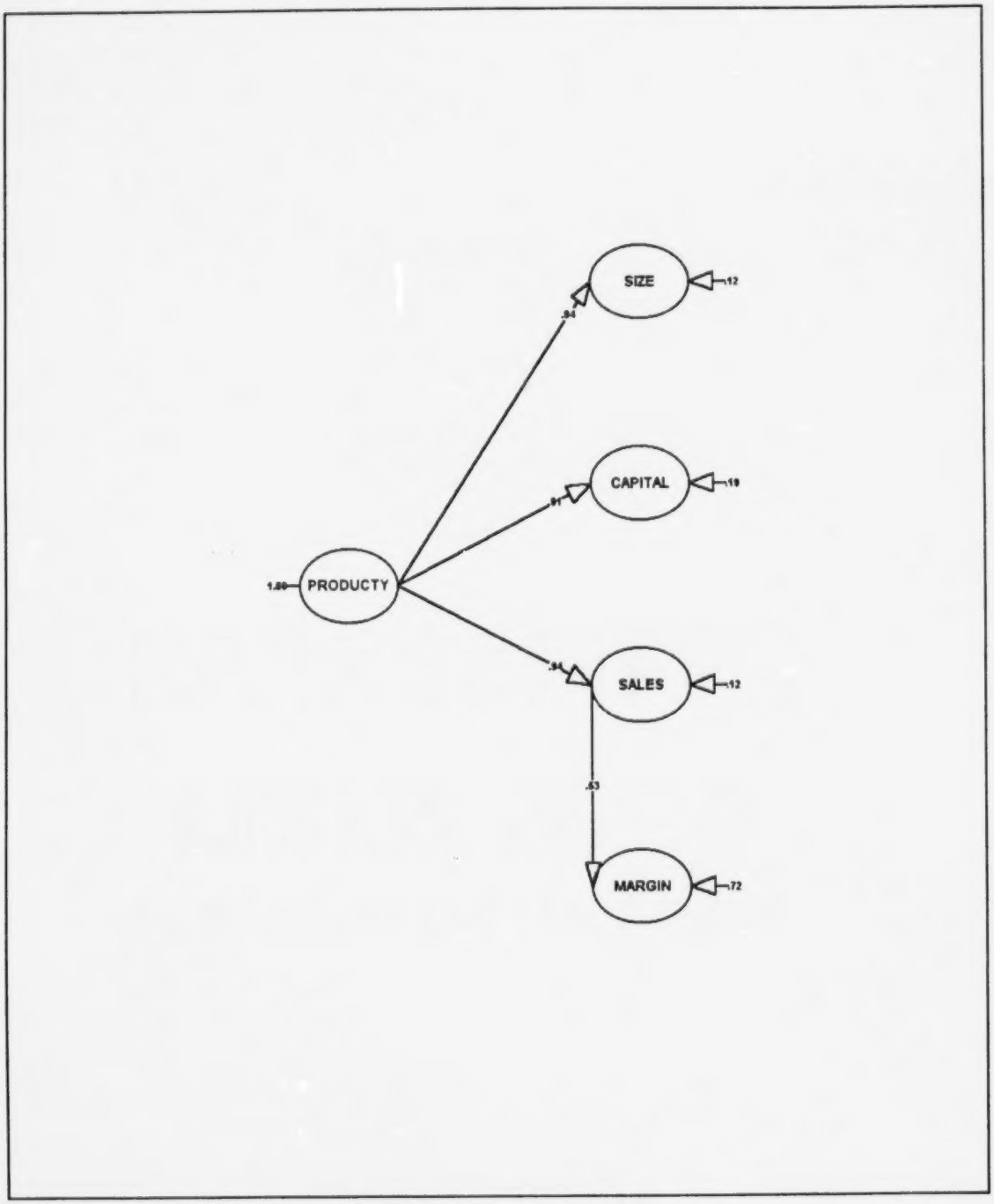

Figure 24 Productivity Model Structural T-Values

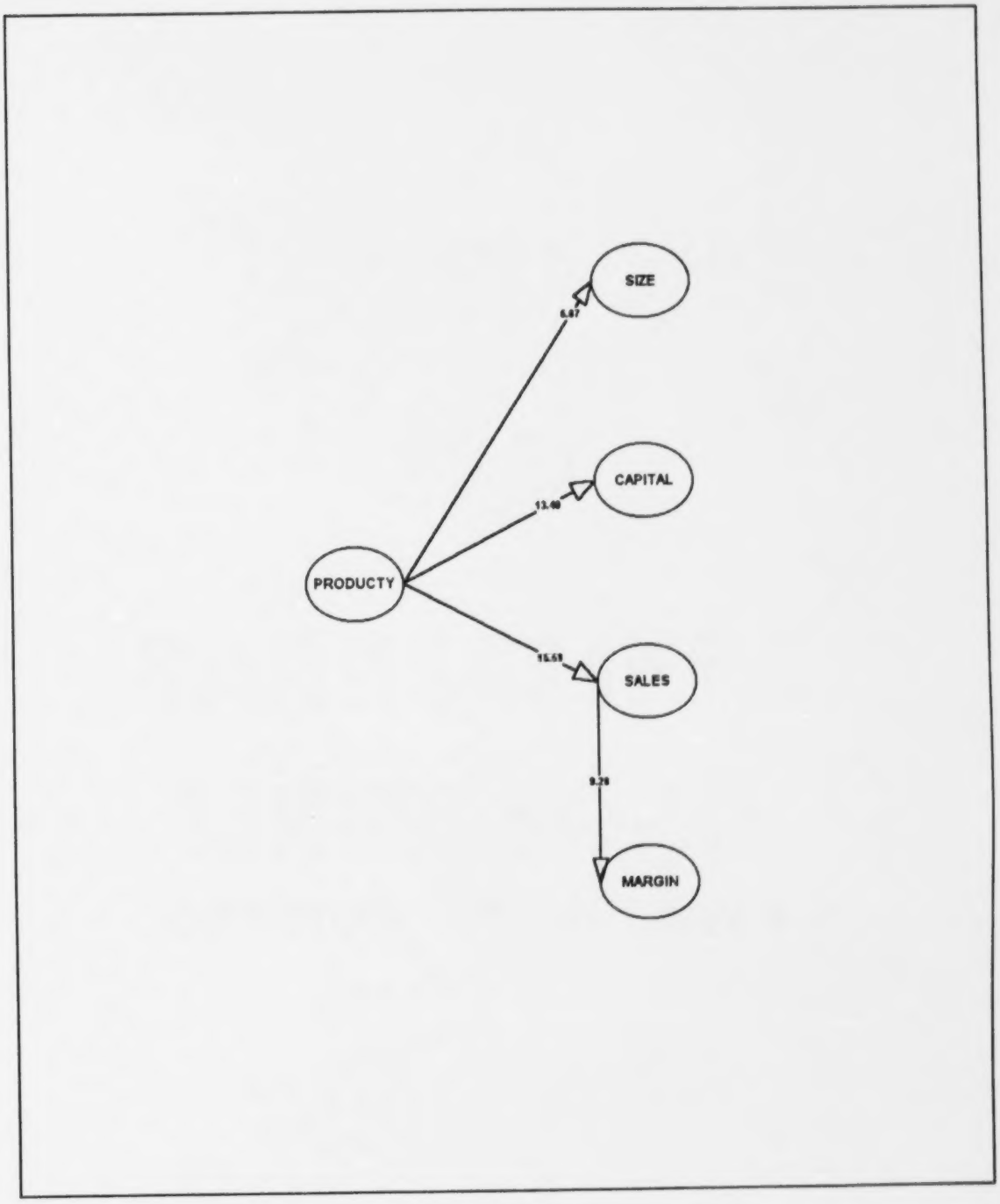

Figure 25 Productivity Model Correlated Error Estimates

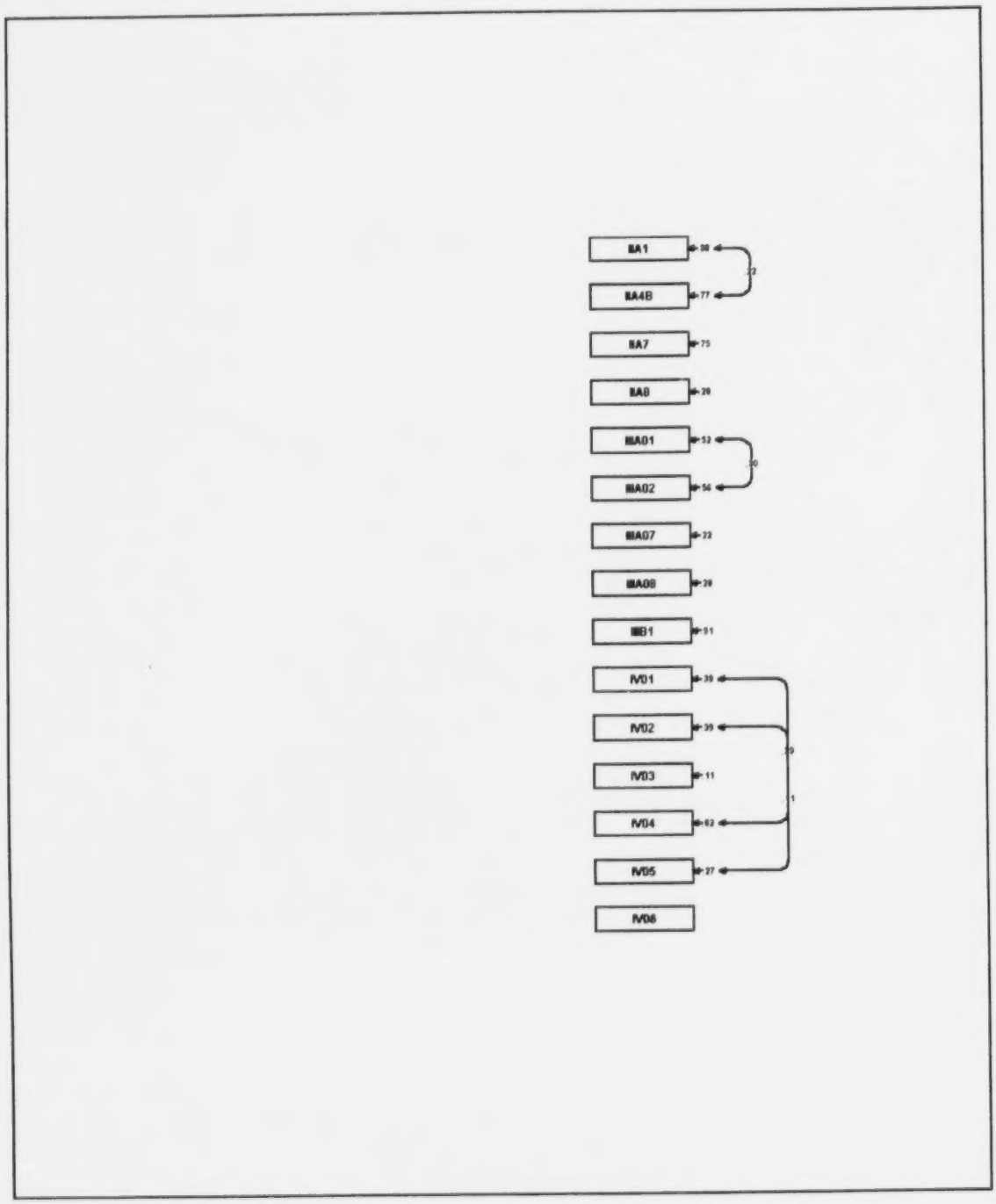
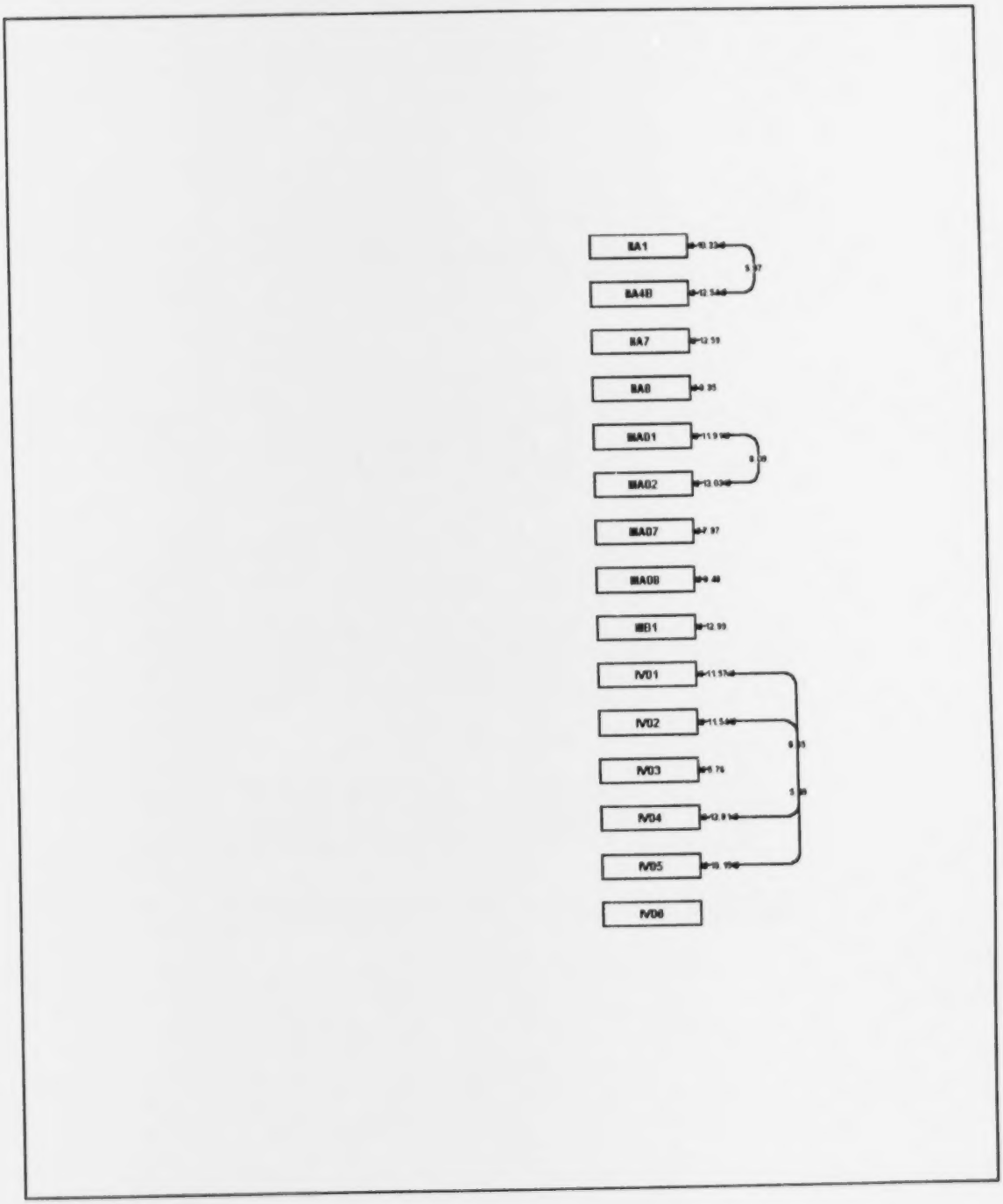
Figure 26 Productivity Model Correlated Error T-Values